MINUTES OF PROCEEDINGS

OF THE

ROYAL SOCIETY OF CANADA

1958

THIRD SERIES, VOLUME LII

PROCÈS-VERBAUX

DE LA

SOCIÉTÉ ROYALE DU CANADA

1958

TROISIÈME SÉRIE, TOME LII

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1957—BISSELL, C. T., M.A., Ph.D., President, University of Toronto, Toronto, Ont.
1943—BLADEN, V. W., M.A., Professor and Chairman, Department of Political Economy, University of Toronto, Toronto, Ont.
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1949—Underhill, F. H., M.A., Curator, Laurier House, Ottawa, Ont.
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1950—Wilson, G. E., M.A., Ph.D., LL.D., Dean of Arts and Science, Dalhousie University, Halifax, N.S.
1942—Woodhouse, A. S. P., A.M., D.Litt., Professor and Head, Department of English, University College, and the School of Graduate Studies, University of Toronto, Toronto, Ont.

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1935—SHRUM, G. M., O.B.E., M.A., Ph.D., Professor and Head, Department of Physics, University of British Columbia, Vancouver, B.C.

1940—SMITH, H. GRAYSON-, M.B.E., M.A., Ph.D., Head, Department of Physics, University of Alberta, Edmonton, Alta.

1943—SPINKS, J. W. T., M.B.E., D.Sc., Ph.D., Head, Department of Chemistry, and Dean of Graduate Studies, University of Saskatchewan, Saskatoon, Sask.

1934—STEACIE, E. W. R., O.B.E., M.Sc., Ph.D., D.Sc., LL.D., D. de l'U., F.R.S., President, National Research Council, Ottawa, Ont. (Past President)

1943—THODE, H. G., M.B.E., M.Sc., Ph.D., D.Sc., F.R.S., Vice-President, McMaster University, Hamilton, Ont.

1935—THOMSON, ANDREW, O.B.E., M.A., 36 Russell Hill Rd., Toronto, Ont.

1926—THORVALDSON, T., Commander, Order of the Falcon (Iceland), M.A., Ph.D., D.Sc., LL.D., University of Saskatchewan, Saskatoon, Sask.
1958—TUTTE, W. T., M.A., M.Sc., Ph.D., Assistant Professor, Department of Mathematics, University of Toronto, Toronto, Ont.
1948—VOLKOFF, G. M., M.B.E., M.A., Ph.D., D.Sc., Professor of Physics, University of British Columbia, Vancouver, B.C.
1945—WALKER, O. J., A.M., Ph.D., Head, Department of Chemistry, Director, School of Graduate Studies, University of Alberta, Edmonton, Alta.
1957—WARD, ARTHUR G., M.A., Research Officer, Atomic Energy of Canada Ltd., Chalk River, Ont.
1937—WATSON, W. H., M.A., Ph.D., Professor and Head, Department of Physics, and Director, Computation Centre, University of Toronto, Toronto, Ont.
1952—WELSH, H. L., M.A., Ph.D., Professor of Physics, University of Toronto, Toronto, Ont.
1955—WETMORE, F. E. W., M.A., Ph.D., Professor of Chemistry, University of Toronto, Toronto, Ont.
1957—WIESNER, K., D.Sc., Professor of Organic Chemistry, University of New Brunswick, Fredericton, N.B.
1935—WILLIAMS, W. L. G., M.A., Ph.D., D.ès-Sc., LL.D., Chemistry Building, McGill University, Montreal, P.Q.
1946—WINKLER, C. A., O.B.E., M.Sc., D.Phil., Professor of Chemistry, McGill University, Montreal, P.Q.
1950—WOONTON, G. A., M.A., D.Sc., MacDonald Professor and Chairman, Department of Physics, Director Eaton Electronics, Research Laboratory, McGill University, Montreal, P.Q.
1956—WRIGHT, G. F., B.Sc., Ph.D., Professor, Department of Chemistry, University of Toronto, Toronto, Ont.
1954—WRIGHT, K. O., M.A., Ph.D., Astrophysicist, Dominion Astrophysical Observatory, Royal Oak, B.C.
1957—WU, TA-YOU, M.A., Ph.D., Senior Research Officer and Head of Theoretical Physics Group, National Research Council, Ottawa, Ont.
1951—WYMAN, MAX, B.Sc., Ph.D., Associate Professor of Mathematics, University of Alberta, Edmonton, Alta.
1958—YAFFE, LÉO, B.Sc., M.Sc., Ph.D., Associate Professor, Department of Chemistry, McGill University, Montreal, P.Q.
1956—ZASSENHAUS, H. J., M.A., Ph.D., Professor, Department of Mathematics, McGill University, Montreal, P.Q.

SECTION IV—GEOLOGICAL AND ALLIED SCIENCES

Retired Members

1920—BANCROFT, J. AUSTEN, Ph.D., D.Sc., Consulting Geologist, Anglo American Corporation of South Africa, Johannesburg, South Africa
1928—BOYD, W. H., B.A.Sc., 69 Dunvegan Rd., Toronto, Ont.
1928—DELURY, J. S., Ph.D., P.O. Box 22, Uxbridge, Ont.
1920—GRAHAM, R. P. D., D.Sc., 775 Davaar Ave., Outremont, P.Q.
1930—HANSON, GEORGE, M.A., Ph.D., 27 Nolan Street, Ottawa, Ont.
1920—KNIGHT, C. W., B.Sc., Consulting Geologist, 1545 Glenburnie Road, Port Credit, Ont.
1928—MACKAY, B. R., B.Sc., Ph.D., 193 Carling Ave., Ottawa, Ont.
1926—MALCOLM, WYATT, M.A., 376 Hinton Ave., Ottawa, Ont.
1932—WRIGHT, W. J., M.A., Ph.D., LL.D., 117 Church St., Fredericton, N.B.

Active Members

1925—ALCOCK, F. J., Ph.D., 398 Third Ave., Ottawa, Ont.
1944—AMBROSE, J. W., Ph.D., Professor of Geology, Queen's University, Kingston, Ont.
1950—ARMSTRONG, J. E., M.A.Sc., Ph.D., Geologist, Geological Survey of Canada, 739 W. Hastings St., Vancouver, B.C.
1957—ARMSTRONG, H. S., M.A., Ph.D., Professor of Geology, Dean of Arts and Science McMaster University, Hamilton, Ont.
1950—AUGER, P. E., B.Sc., Ph.D., Professor of Geology, Laval University, Quebec, P.Q.
1958—BAIRD, D. M., B.Sc., M.S., Ph.D., Department of Geology, University of Ottawa, Ottawa, Ont.
1925—BELL, W. A., B.Sc., Ph.D., LL.D., 82 Terrace Street, New Glasgow, N.S.
1951—BERRY, L. G., M.A., Ph.D., Professor of Mineralogy, Queen's University, Kingston, Ont.
1940—BOSTOCK, H. S., M.Sc., Ph.D., Senior Geologist, Geological Survey of Canada, Ottawa, Ont.
1957—BOYLE, R. W., M.A.Sc., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1951—BROWNELL, G. M., M.Sc., Ph.D., Professor and Chairman, Department of Geology and Mineralogy, University of Manitoba, Winnipeg, Man.
1955—BYERS, A. R., M.Sc., Ph.D., Professor, Department of Geology, University of Saskatchewan, Saskatoon, Sask.
1948—CALEY, J. F., M.Sc., M.A., Ph.D., Chief, Fuels and Stratigraphic, Geology Division, Geological Survey of Canada, Ottawa,Ont.
1953—CAMPBELL, NEIL, B.Sc., Ph.D., District Geologist, Consolidated Mining and Smelting Company, Trail, B.C.
1918—CAMSELL, CHARLES, C.M.G., LL.D., Commissioner, Federal District Commission, Ottawa, Ont. (Past President)
1933—CLARK, T. H., A.M., Ph.D., Logan Professor, Department of Geological Sciences, McGill University, Montreal, P.Q.
1943—DENIS, B. T., B.Sc., Ph.D., Bureau of Mines, Quebec, P.Q.
1946—DERRY, D. R., M.A., Ph.D., Vice-President, Rio Tinto Mining Company of Canada Ltd., 335 Bay St., Toronto, Ont.
1926—DOLMAGE, VICTOR, Ph.D., Consulting Geologist, 355 Burrard St., Vancouver, B.C.
1944—DOUGLAS, G. V., M.C., M.Sc., 40 Sherbourne St. North, Toronto, Ont.
1950—EDMUNDS, F. H., M.Sc., Professor of Geology, University of Saskatchewan, Saskatoon, Sask.
1956—FOLINSBEE, R. E., M.Sc., Ph.D., Professor and Chairman, Department of Geology, University of Alberta, Edmonton, Alta.
1953—FORTIER, Y. O., M.Sc., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1950—FRASER, H. J., M.Sc., Ph.D., President, Falconbridge Nickel Mines, Ltd., 44 King St., West, Toronto, Ont. (Life Member)
1955—FREBOLD, HANS, D.Phil., Head, Section of Stratigraphic Palaeontology, Geological Survey of Canada, Ottawa, Ont.
1942—FRITZ, MADELEINE A., M.A., Ph.D., Professor of Geological Sciences, University of Toronto, Toronto, Ont.
1947—FURNIVAL, G. M., M.A., Ph.D., 24 Caperton St., Piedmont 11, California, U.S.A.
1938—GILL, J. E., B.Sc., Ph.D., Professor of Geology, McGill University, Montreal, P.Q.
1935—GUNNING, H. C., B.A.Sc., S.M., Ph.D., Dean, Applied Science, Head, Geology and Geography, University of British Columbia, Vancouver, B.C.
1955—GUSSOW, W. C., M.Sc., Ph.D., Union Oil Co., 709 8th Ave. W., Calgary, Alta.
1957—HAGE, CONRAD O., B.Sc., M.A., Chief Geologist, Dome Exploration (Western) Ltd., Calgary, Alta.
1958—HARDY, R. M., B.Sc., M.Sc., D.Sc., Dean and Professor of Civil Engineering, University of Alberta, Edmonton, Alta. (Life Member)

1952—HARRISON, J. M., M.A., Ph.D., Director, Geological Survey of Canada, Ottawa, Ont.

1934—HAWLEY, J. E., M.A., Ph.D., Miller Memorial Research Professor and Chairman, Graduate Studies, Department of Geological Sciences, Queen's University, Kingston, Ont.

1947—HENDERSON, J. F., M.Sc., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.

1956—HEWITT, D.F., M.S., Ph.D., Geologist, Ontario Department of Mines, Toronto, Ont.

1958—HODGSON, JOHN H., M.A., Ph.D., Chief, Division of Seismology, Dominion Observatory, Ottawa, Ont.

1929—HUME, G. S., O.B.E., Ph.D., Westcoast Transmission Co. Ltd., Pacific Bldg., 9th Ave., Calgary, Alta. (Past President)

1940—HURST, M. E., M.A., Ph.D., Provincial Geologist, Ontario Department of Mines, Toronto, Ont.

1958—JACOBS, J. A., M.A., Ph.D., Professor, Department of Geophysics, University of British Columbia, Vancouver, B.C.

1954—JAMES, W. F., M.Sc., Ph.D., D.Sc., Consulting Geologist, Suite 1505, 320 Bay St., Toronto, Ont.

1919—JOHNSTON, R. A. A., B.A., 105 Old Forest Hill Rd., Toronto 10, Ont.

1943—JOLLIFFE, A. W., M.A., Ph.D., Queen's University, Kingston, Ont. (Life Member)

1941—JONES, I. W., B.Sc., Ph.D., Bureau of Mines, Quebec, P.Q.

1948—KINDLE, E. D., M.A., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.

1951—LANG, A. H., M.A., Ph.D., Chief, Mineral Deposits Division, Geological Survey of Canada, Ottawa, Ont.

1940—LANGFORD, G. B., B.A.Sc., Ph.D., Head, Department of Geological Sciences, University of Toronto, Toronto, Ont.

1949—LAVERDIÈRE, l'abbé J. W., L.ès Sc., D.ès Sc., Docteur en Droit, Séminaire de Québec, Québec, P.Q.

1956—LEGGET, R. F., B.Eng., M.Eng., Director, Division of Building Research, National Research Council, Ottawa, Ont.

1949—LORD, C. S., M.A.Sc., Ph.D., Chief Geologist, Geological Survey of Canada, Ottawa, Ont.

1952—MACKENZIE, G. S., M.A., Ph.D., University of New Brunswick, Fredericton, N.B.

1957—MATHEWS, W. H., M.A.Sc., Ph.D., Associate Professor, Division of Geology, University of British Columbia, Vancouver, B.C.

1933—MAWDSLEY, J. B., M.B.E., B.Sc., Ph.D., University of Saskatchewan, Saskatoon, Sask.

1947—MCGERRIGLE, H. W., Ph.D., Geologist, Quebec Department of Mines, Quebec, P.Q.

1927—MCLEARN, F. H., B.E., Ph.D., 817 Ivanhoe Ave., Britannia Heights (Ottawa), Ont.

1924—MOORE, E. S., M.A., Ph.D., LL.D., Department of Geological Sciences, University of Toronto, Toronto, Ont. (Past President)

1937—NORMAN, G. W. H., B.A.Sc., Ph.D., Newmont Exploration Ltd., P.O. Box 99, Montrose, Colorado, U.S.A.

1945—OKULITCH, V. J., M.A.Sc., Ph.D., Professor and Chairman, Division of Geology, University of British Columbia, Vancouver, B.C.

1925—O'NEILL, J. J., M.Sc., Ph.D., D.Sc., 260 Metcalfe St., Ottawa, Ont. (Past President)

1937—OSBORNE, F. F., M.A.Sc., Ph.D., Professor of Petrology, Laval University, Quebec, P.Q.

1927—POITEVIN, EUGÈNE, C.E., B.A.Sc., D.Sc., 355 Wilbrod Street, Ottawa, Ont.

1946—RICE, H. M. A., M.A.Sc., Ph.D., Chief Geological Editor, Geological Survey of Canada, Ottawa, Ont.

1956—RIDDELL, J. E., B.Eng., M.Sc., Ph.D., Department of Geology, Carleton University, Ottawa, Ont.

1936—Rickaby, H. C., M.A., Deputy Minister of Mines, Parliament Bldgs., Toronto, Ont.
1954—Robinson, S. C., M.A.Sc., Ph.D., Chief, Mineralogy Division, Geological Survey of Canada, Ottawa, Ont.
1954—Roliff, W. A., B.Sc., Manager, Eastern Division, Producing Dept., Imperial Oil Ltd., 111 St. Clair Ave. West, Toronto, Ont.
1936—Russell, L. S., M.A., Ph.D., Director, Natural History Branch, National Museum of Canada, Ottawa, Ont.
1954—Satterly, Jack, M.A., Ph.D., Geologist, Ontario Department of Mines, Toronto, Ont.
1938—Slipper, S. E., B.Sc., 13051, 9th Ave., N.W., Seattle, Wash., U.S.A.
1955—Sproule, J. C., M.A., Ph.D., J. C. Sproule and Associates, Geological Consultants, 901–8th Ave. West, Calgary, Alta.
1949—Sternberg, C. M., 169 Holmwood Ave., Ottawa, Ont.
1949—Stevenson, J. S., B.A.Sc., Ph.D., Associate Professor of Mineralogy, McGill University, Montreal, P.Q.
1936—Stockwell, C. H., B.A.Sc., Ph.D., Chief, Precambrian Division, Geological Survey of Canada, Ottawa, Ont.
1939—Swanson, C. O., M.A.Sc., Ph.D., Chief Geologist, Consolidated Mining & Smelting Co., Ltd., Trail, B.C.
1927—Tanton, T. L., M.A., Ph.D., Consulting Geologist, 9 Grosvenor Ave., Ottawa, Ont.
1945—Thomson, J. E., M.A., Ph.D., Assistant Provincial Geologist, Department of Mines, Toronto, Ont.
1937—Walker, J. F., B.A.Sc., Ph.D., Deputy Minister of Mines, Province of British Columbia, Victoria, B.C.
1945—Warren, H. V., B.Sc., D.Phil., Professor, Department of Geology and Geography, University of British Columbia, Vancouver, B.C.
1931—Warren, P. S., Ph.D., A.R.C.S., Professor Emeritus, University of Alberta, Edmonton, Alta.
1953—Watson, J. W., M.A., Ph.D., Professor of Geography, Edinburgh University, Edinburgh, Scotland
1953—Weeks, L. J., B.Sc., M.A., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.
1939—Wickenden, R. T. D., Ph.B., M.A., Ph.D., 406 Customs Bldg., Calgary, Alta.
1926—Williams, M. Y., B.Sc., Ph.D., Professor Emeritus of Geology, University of British Columbia, Vancouver, B.C.
1938—Wilson, Alice E., M.B.E., Ph.D., 328 McLeod St., Ottawa, Ont.
1948—Wilson, J. Tuzo, O.B.E., B.A., Sc.D., Ph.D., LL.D., D.Sc., Professor of Geophysics, University of Toronto, Toronto, Ont.
1924—Wilson, M. E., Ph.D., 22 Monkland Ave., Ottawa, Ont.
1932—Wright, J. F., Ph.D., Geologist, Geological Survey of Canada, Ottawa, Ont.

Section V—BIOLOGICAL SCIENCES

Retired Members

1924—Boyd, William, M.D., LL.D., D.Sc., 40 Arjay Crescent, Willowdale, Ont.
1936—Brittain, W. H., B.S.A., M.S., Ph.D., D.Sc., Curator, Morgan Arboretum, Dept. of Woodlot Management, Macdonald College, P.Q.
1919—Cameron, John, M.S., D.Sc., M.R.C.S., 63 Grove Road, Bournemouth, England
1946—Craigie, James, O.B.E., M.B., Ph.D., D.P.H., F.R.S., Imperial Cancer Research Fund, Burtonhole Lane, The Ridgeway, Mill Hill, N.W. 7, London, England

1938—Drayton, F. L., B.S.A., Ph.D., Associate Chief, Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa, Ont.
1921—Faull, J. H., Ph.D., 72 Fresh Pond Lane, Cambridge 38, Mass., U.S.A.
1922—Gibson, Arthur, LL.D., 183 King St. E., Brockville, Ont.
1931—Gussow, H. T., LL.D., F.R.M.S., Hon. F.R.H.S., 2605 Killarney Rd., Victoria, B.C.
1916—Hunter, Andrew, C.B.E., M.A., B.Sc., M.B., Ch.B., F.R.S.E., 2 Sultan St., Toronto, Ont.
1943—Kirk, L. E., M.S.A., Ph.D., Food and Agricultural Organization of U.N., Rome, Italy
1945—Leach, W., M.Sc., Ph.D., D.Sc., Dencross Terrace, Saanichton, B.C.
1932—Macallum, A. B., M.B., M.D., Ph.D., R.R. 3, Lunenberg, N.S.
1924—Macklin, C. C., M.B., M.A., Ph.D., D.Sc., 37 Gerrard St., London, Ont.
1937—Marrian, G. F., D.Sc., F.R.I.C., F.R.S., Department of Medical Chemistry, University of Edinburgh, Edinburgh, Scotland
1937—McDunnough, J. H., M.A., Ph.D., Nova Scotia Museum of Science, Halifax, N.S.
1926—Meakins, J. C., C.B.E., M.D., C.M., LL.D., F.A.C.P., F.R.C.P.(C.), F.R.S.E., 3640 University St., Montreal, P.Q.
1922—Miller, James, M.D., D.S.C., F.R.C.P.E., F.R.C.P.(C), Painswick House, near Strough, Gloucestershire, England
1922—Miller, F. R., M.A., M.B., M.D., F.R.C.P.(C), F.R.S., 280 Carlton St., Toronto, Ont.
1930—Newton, Robert, M.C., B.S.A., M.Sc., Ph.D., 1972 Robson St., Vancouver 8, B.C.
1922—O'Donoghue, C. H., D.Sc., F.R.S.E., University of Reading, Reading, England
1915—Walker, E. M., M.B., 120 Cheltenham Ave., Toronto, Ont.

Active Members

1944—Anderson, J. A., M.Sc., Ph.D., Chief Chemist, Board of Grain Commissioners for Canada, Winnipeg, Man.
1939—Anderson, R. M., B.Ph., Ph.D., 58, The Driveway, Ottawa, Ont.
1937—Bailey, D. L., M.S., Ph.D., Professor of Plant Pathology, University of Toronto, Toronto, Ont.
1952—Bannan, M. W., Ph.D., Associate Professor of Botany, University of Toronto, Toronto, Ont.
1958—Barr, Murray, L., M.D., M.Sc., Professor and Head, Department of Microscopic Anatomy, University of Western Ontario, London, Ont.
1958—Bélanger, L.-F., M.D., M.A. (Med. Sc.), Professeur titulaire d'Histologie et Embr., Faculté de Médecine, Université d'Ottawa, Ottawa (Ont.)
1956—Bernard, Richard, M.Sc., Ph.D., Professeur titulaire de physiologie animale, département de biologie, Université Laval, Québec (P.Q.)
1936—Berrill, N. J., Ph.D., D.Sc., F.R.S., Strathcona Professor of Zoology, McGill University, Montreal, P.Q.
1931—Best, C. H., C.B.E., M.A., M.D., D.Sc., LL.D., F.R.S., Professor and Head of Department of Physiology and Director of Banting & Best Department of Medical Research, Charles H. Best Institute, University of Toronto, Toronto, Ont.
1958—Bishop, C. J., B.Sc., A.M., Ph.D., Superintendent, Experimental Farm, Department of Agriculture, Kentville, N.S.
1956—Black, E. C., M.B.E., M.A., Ph.D., Associate Professor, Department of Physiology, University of British Columbia, Vancouver, B.C.
1939—Browne, J. S. L., B.Sc., M.D., C.M., Ph.D., LL.D., Professor and Chairman, Dept. of Investigative Medicine, McGill University, Montreal, P.Q.
1952—Burton, A. C., M.B.E., B.Sc., M.A., Ph.D., Professor of Biophysics, University of Western Ontario, London, Ont.

1957—Butler, G. C., M.A., Ph.D., Atomic Energy of Canada, Ltd., Chalk River, Ont.

1939—Cameron, T. W. M., T.D., M.A., Ph.D., D.Sc., M.R.C.V.S., Professor and Chairman, Department of Parasitology, McGill University, Director, Institute of Parasitology, Macdonald College, P.Q. (Past President)

1933—Campbell, W. R., M.A., M.B., M.D., F.R.C.P. (C), Medical Arts Bldg., Toronto, Ont.

1955—Cantero, Antonio, M.D., C.M., Director of Research, Notre Dame Hospital, Montreal Cancer Institute, Montreal, P.Q.

1925—Clemens, W. A., M.A., Ph.D., Professor Emeritus and Special Lecturer in Zoology, University of British Columbia, Vancouver, B.C.

1954—Collier, H. B., M.A., Ph.D., Professor and Head, Department of Biochemistry, University of Alberta, Edmonton, Alta.

1925—Collip, J. B., C.B.E., Ph.D., M.D., D.Sc., LL.D., F.R.S., Dean of Medicine, University of Western Ontario, London, Ont. (Past President)

1944—Cone, W. V., B.S., M.D., Professor of Neurosurgery, McGill University, Neurosurgeon-in-Chief, Royal Victoria Hospital and Montreal Neurological Institute, Montreal, P.Q.

1943—Cook, W. H., O.B.E., M.Sc., Ph.D., LL.D., Director, Division of Applied Biology, National Research Council, Ottawa, Ont.

1957—Cormack, R. G. H., M.A., Ph.D., Professor of Botany, University of Alberta, Edmonton, Alta.

1946—Cowan, Ian McT., Ph.D., Professor and Head, Department of Zoology, University of British Columbia, Vancouver, B.C.

1935—Craigie, E. Horne, Ph.D., Professor of Comparative Anatomy and Neurology, Department of Zoology, University of Toronto, Toronto, Ont.

1936—Craigie, J. H., M.S., Ph.D., D.Sc., LL.D., F.R.S., Principal Plant Pathologist, Science Service, Department of Agriculture, Ottawa, Ont.

1945—Crampton, E. W., M.Sc., Ph.D., Professor and Chairman, Department of Nutrition, Professor of Animal Husbandry, Macdonald College, P.Q.

1949—Dansereau, Pierre, B.A., B.Sc.Agr., D.Sc., Institut de botanique, Université de Montréal, 4101 est, rue Sherbrooke, Montréal 36, (P.Q.)

1953—Dauphinee, J. A., O.B.E., M.A., Ph.D., M.D., Professor of Pathological Chemistry and Head of the Department, University of Toronto, Toronto, Ont.

1952—Daviault, Lionel, L.Sc.A., M.Sc., D.Sc., Officer in Charge, Laboratory of Forest Zoology, Science Service, Canadian Department of Agriculture, Quebec, P.Q.

1947—Dolman, C. E., M.B., B.S., D.P.H., Ph.D., Professor and Head, Department of Bacteriology & Immunology, University of British Columbia, Vancouver, B.C.

1951—Dugal, L.-Paul, O.B.E., M.A., Ph.D., Département de biologie, Université d'Ottawa, Ottawa (Ont.)

1954—Dunbar, M. J., M.A., Ph.D., Associate Professor of Zoology, McGill University, Montreal, P.Q.

1938—Dymond, J. R., O.B.E., M.A., D.Sc., Professor emeritus of Zoology, University of Toronto, Toronto, Ont.

1952—Eagles, Blythe, M.A., Ph.D., Dean, Faculty of Agriculture, and Head, Department of Dairying, University of British Columbia, Vancouver, B.C.

1941—Ettinger, G. H., M.B.E., M.D., C.M., Dean, Faculty of Medicine, Queen's University, Kingston, Ont.

1958—Fallis, A. Murray, B.A., Ph.D., Director, Department of Parasitology, Ontario Research Foundation and Professor of Parasitology, University of Toronto, Toronto, Ont.

1948—Ferguson, J. K. W., M.B.E., M.A., M.D., Connaught Medical Research Laboratories, University of Toronto, Toronto, Ont.

1949—Fisher, K. C., M.A., Ph.D., Dept. of Zoology, University of Toronto, Toronto, Ont.

1939—FOERSTER, R. E., M.A., Ph.D., Principal Scientist, Fisheries Research Board of Canada, Pacific Biological Station, Nanaimo, B.C.

1949—FRAPPIER, ARMAND, O.B.E., M.D., L.ès Sc., Officier d'Académie, Professeur de bactériologie à la Faculté de Médecine, Doyen de l'Ecole d'Hygiène et Directeur de l'institut de Microbiologie et d'Hygiène de l'Université de Montréal, Montréal (P.Q.)

1948—FRY, F. E. J., M.B.E., M.A., Ph.D., Associate Professor of Limnology, Department of Zoology, University of Toronto, Toronto, Ont.

1952—GIBBARD, JAMES, B.S.A., S.M., Director, Laboratory of Hygiene, Department of National Health & Welfare, Ottawa, Ont.

1939—GIBBS, R. D., M.Sc., Ph.D., F.L.S., Professor of Botany, McGill University, Montreal 2, P.Q.

1955—GIBBONS, N. E., M.B.E., M.A., Ph.D., Head, Food Microbiology Section, Division of Applied Biology, National Research Council, Ottawa, Ont.

1941—GOULDEN, C. H., M.S.A., Ph.D., LL.D., Director, Experimental Farms Service, Department of Agriculture, Ottawa, Ont.

1948—GRACE, N. H., M.B.E., M.A., Ph.D., Director, Research Council of Alberta, Edmonton, Alta.

1938—GRAHAM, D. A., C.B.E., M.D., D.Sc., LL.D., F.R.C.P. (C) (London), 343 Lytton Boulevard, Toronto, Ont.

1951—GROVES, J. W., M.A., Ph.D., Head, Mycology Unit, Science Service, Department of Agriculture, Ottawa, Ont.

1957—HAIST, R. E., M.D., M.A., Ph.D., Professor of Physiology, University of Toronto, Toronto, Ont.

1944—HALL, G. E., M.S.A., M.D., Ph.D., D.ès Sc., LL.D., President and Vice-Chancellor, University of Western Ontario, London, Ont.

1951—HAM, A. W., M.B., Professor of Anatomy, Department of Anatomy, University of Toronto, Toronto, Ont.

1944—HANNA, W. F., C.B.E., O.L.M. (U.S.A.), M.Sc., Ph.D., LL.D., Chief, Botany and Plant Pathology Division, Department of Agriculture, Ottawa, Ont.

1956—HANES, C. S., Ph.D., Sc.D., F.R.S., Professor of Biochemistry, Department of Chemistry, University of Toronto, Toronto, Ont.

1943—HART, J. L., M.A., Ph.D., Director, Fisheries Research Board of Canada, Biological Station, St. Andrews, N.B.

1947—HAYES, F. R., M.Sc., Ph.D., D.Sc., G. S. Campbell Professor of Biology and Head of the Department, Dalhousie University, Halifax, N.S.

1953—HEIMBURGER, C. C., M.Sc.F., Ph.D., Biologist in charge of forest tree breeding, Ontario Department of Lands and Forests, Maple, Ont.

1955—HOAR, W. S., M.A., Ph.D., Professor of Zoology and Fisheries, University of British Columbia, Vancouver, B.C.

1951—HOPKINS, J. W., M.Sc., Ph.D., National Research Council, Ottawa, Ont.

1917—HUNTSMAN, A. G., B.A., M.D., Department of Zoology, University of Toronto (Oct. to May), St. Andrews, N.B. (May to Oct.) (Past President)

1933—HUTCHINSON, A. H., M.A., Ph.D., Emeritus Professor and Special Lecturer, Department of Biology & Botany, University of British Columbia, Vancouver, B.C.

1952—JAQUES, L. B., M.A., Ph.D., Professor and Head, Department of Physiology and Pharmacology, University of Saskatchewan, Saskatoon, Sask.

1950—JOHNSON, T., B.S.A., M.Sc., Ph.D., Officer in Charge, Plant Pathology Laboratory, Science Service, Canada Agriculture, Winnipeg, Man.

1950—KROTKOV, G., Agr. Eng., M.A., Ph.D., Professor of Biology, Queen's University, Kingston, Ont.

1945—LABARRE, JULES, B.Ph., L.ès S., D.ès S., Professeur de pharmacie, Université de Montréal, Montréal (P.Q.)

1946—LARMOUR, R. K., M.Sc., Ph.D., Director of Research, Maple Leaf Milling Co., Limited, Toronto 9, Ont.

1951—LEBLOND, C. P., M.D., L.ès Sc., Ph.D., D.Sc., Professor of Anatomy, McGill University, Montreal, P.Q.

1949—LEDINGHAM, G. A., M.B.E., M.Sc., Ph.D., Director, Prairie Regional Laboratory, National Research Council Laboratories, Saskatoon, Sask.

1940—LOCHHEAD, A. G., M.Sc., Ph.D., Bacteriology Division, Science Service, Department of Agriculture, Ottawa, Ont.

1956—MACINTOSH, F. C., M.A., Ph.D., F.R.S., Joseph Morley Drake Professor of Physiology and Chairman of Department, McGill University, Montreal, P.Q.

1944—MAHEUX, GEORGES, M.A., I.F., M.Sc.Ag., D.Sc., Professeur, Faculté de Génie forestier, Université Laval, Québec (P.Q.)

1941—MAINLAND, D., M.B., Ch.B., D.Sc., F.R.S.E., Professor of Medical Statistics and Chairman of Department, New York University College of Medicine, New York, N.Y.

1931—MASSON, C. L. P., L.ès Sc., M.D., Docteur Honoris Causa de l'Université de Montréal et de l'Université McGill, Directeur du département d'Anatomie pathologique, Université de Montréal, Montréal (P.Q.)

1953—MCCALLA, A. G., M.Sc., Ph.D., Dean, Faculty of Graduate Studies, University of Alberta, Edmonton, Alta.

1942—MCFARLANE, W. D., M.A., B.Sc.(Agr.), Ph.D., Director of Research, Canadian Breweries Limited, Research Division, 307 Fleet St. E., Toronto, Ont.

1942—MCHENRY, E. W., M.A., Ph.D., Professor of Nutrition, School of Hygiene, University of Toronto, Toronto, Ont.

1945—MITCHELL, C. A., B.V.Sc., D.V.M., Kirk's Ferry, P.Q.

1936—MOLONEY, P. J., O.B.E., M.A., Ph.D., Connaught Laboratories, University of Toronto, Toronto, Ont.

1938—MOORHOUSE, V. H. K., M.C., B.A., M.B., M.D., 32 Amanda St., Orangeville, Ont.

1950—MORIN, J. E., M.D., M.C.R.M.(C), C.M.C.P.Q., Hôpital Saint-Sacrement, 1050, Chemin Ste-Foy, Québec (P.Q.)

1947—MORRELL, C. A., M.A., Ph.D., Director, Food and Drug Division, Department of National Health and Welfare, Ottawa, Ont.

1938—MOSS, E. H., M.A., Ph.D., Professor Emeritus of Botany, University of Alberta, Edmonton, Alta.

1938—MURRAY, E. G. D., O.B.E., M.A., L.M.S.S.A., M.D., D.Sc., Collip Medical Research Laboratory, University of Western Ontario, London, Ont.

1958—MURRAY, R. G. E., M.A., M.D., G.M., Professor of Bacteriology and Immunology, University of Western Ontario, London, Ont.

1954—NEAVE, FERRIS, M.Sc., Ph.D., Principal scientist, Fisheries Research Board, Biological Station, Nanaimo, B.C.

1945—NEEDLER, A. W. H., O.B.E., M.A., Ph.D., D.Sc., Director, Fisheries Research Board, Biological Station, Nanaimo, B.C.

1942—NEWTON, MARGARET, B.S.A., M.Sc., Ph.D., 2392 Beach Dr., Victoria, B.C.

1950—NOBLE, R. L., M.D., Ph.D., D.Sc., Professor and Associate Director, Collip Medical Research Laboratory, University of Western Ontario, London, Ont.

1953—ORR, J. H., M.D., C.M., F.R.C.P.(C), Queen's University, Kingston, Ont.

1955—PAGÉ, E., M.B.E., B.S.A., Ph.D., Directeur, Département de biologie, Université de Montréal, Case postale 6128, Montréal (P.Q.)

1957—PANISSET, M. G., B.A., D.V., D.V.M., Directeur-adjoint, Institut de Microbiologie et d'Hygiène de l'Université de Montréal, Professeur titulaire, École d'Hygiène; Professeur École Vétérinaire de la Province de Québec, Montréal (P.Q.)

1935—PENFIELD, WILDER G., O.M., C.M.G., Litt.B., M.D., M.A., B.Sc., D.Sc., F.R.S., Professor and Chairman of Neurology and Neuro-Surgery; Director, Montreal Neurological Institute, Montreal, P.Q.

1948—POMERLEAU, RENÉ, B.S.A., M.Sc., D.Sc., Chef de laboratoire, Lab. de biologie forestière, Section pathologie, Université Laval, Québec (P.Q.)

1946—PORSILD, A. E., M.B.E., Ph.D., Chief Botanist and Curator of the National Herbarium of Canada, National Museum, Ottawa, Ont.

1942—PRÉFONTAINE, GEORGES, M.D., L.Sc., D.Sc., Hôpital Saint-Joseph de Rosemont, Montréal (P.Q.)

1953—QUASTEL, J. H., A.R.C.S., D.Sc., Ph.D., F.R.S., Professor of Biochemistry, McGill University, Montreal, and Director, McGill-Montreal General Hospital Research Institute, Montreal, P.Q.

1944—RAWSON, DONALD S., M.A., Ph.D., Professor and Head, Department of Biology University of Saskatchewan, Saskatoon, Sask.

1954—RAYMOND, MARCEL, L.Sc., Botaniste, taxonomiste, Jardin Botanique de Montréal, Montréal (P.Q.)

1956—REMPEL, J. G., M.Sc., Ph.D., Professor, Department of Biology, University of Saskatchewan, Saskatoon, Sask.

1957—RHODES, A. J., M.B., Ch.B., M.D., F.R.C.P. (Edin.), Director, School of Hygiene, Professor of Microbiology, School of Hygiene, University of Toronto, Toronto, Ont.

1956—RICKER, W. E., M.A., Ph.D., Editor, Fisheries Research Board, Biological Station, Nanaimo, B.C.

1954—ROSSITER, R. J., B.Sc., M.A., D.Phil., B.M.B.Ch., D.M., Department of Biochemistry, John Curtin School of Medicine, Australian National University, Canberra, Australia.

1942—ROUSSEAU, JACQUES, B.A., L.Sc., D.Sc., Ph.D., 5208 Côte St-Antoine, Montréal, (P.Q.)

1939—SCOTT, D. A., M.A., Ph.D., F.R.S., Research member, Connaught Medical Research, Laboratories, University of Toronto, Toronto 5, Ont.

1941—SELYE, HANS, M.D., Ph.D., D.Sc., Institut de Médecine et de Chirurgie Expérimentales, Université de Montréal, Montréal (P.Q.)

1955—SENN, H. A., M.A., Ph.D., Head, Botany Unit, Botany & Plant Pathology Division, Science Service, Dept. of Agriculture, Ottawa, Ont.

1946—SHANER, R. F., Ph.B., Ph.D., Professor of Anatomy, University of Alberta, Edmonton, Alta.

1935—SIFTON, H. B., M.A., Ph.D., Head, Department of Botany, University of Toronto, Toronto, Ont.

1940—SIMARD, L. C., M.D., F.R.C.P. (C), 624 Dunlop, Outremont (Montréal), P.Q.

1948—SOLANDT, O. M., O.B.E., B.Sc., M.A., M.D., D.Sc., M.R.C.P., LL.D., Vice-President, Research and Development, Canadian National Railways, 360 McGill St., Montreal, P.Q.

1951—SPEAKMAN, H. B., B.Sc., M.Sc., D.Sc., LL.D., Director, Ontario Research Foundation, Toronto, Ont.

1953—STRICKLAND, E. H., M.Sc., D.Sc., 3012 Sea View Road, Victoria, B.C.

1957—TARR, H. L. A., M.S.A., Ph.D. (McGill), Ph.D. (Cantab.), Fisheries Research Board of Canada, Technological Station, Vancouver, B.C.

1934—TAYLOR, N. B., M.D., M.R.C.S., F.R.C.S., 21 Ardwold Gate, Toronto, Ont.

1950—TEMPLEMAN, W., O.B.E., B.Sc., M.A., Ph.D., Director, Fisheries Research Board, Biological Station, St. John's, Newfoundland

1947—THOMPSON, I. M., B.Sc., M.B., Ch.B., F.R.S.E., Professor of Anatomy and Chairman of the Department, University of Manitoba, Winnipeg, Man.

1921—THOMPSON, W. P., M.A., Ph.D., D.Sc., LL.D., President, University of Saskatchewan, Saskatoon, Sask. (Past President)

1949—THOMPSON, W. R., B.S.A., D.Sc., Ph.D., F.R.S., Director, Commonwealth Institute of Biological Control, Ottawa, Ont.

1936—THOMSON, D. L., M.A., B.Sc., Ph.D., LL.D., Vice-Principal, Dean of the Faculty of Graduate Studies, Professor of Organic and Biological Chemistry, McGill University, Montreal, P.Q.

1950—TREMBLAY, J.-L. B.Sc.A., Ph.D., Faculté des Sciences, Université Laval, Québec, (P.Q.)
1955—VENNING, ELEANOR H., M.Sc., Ph.D., Associate Professor of Experimental Medicine, McGill University, Montreal, P.Q.
1958—WALKER, NORMA FORD, B.A., Ph.D., Associate Professor of Human Genetics, University of Toronto, and Director, Department of Genetics, Hospital for Sick Children, Toronto, Ont.
1934—WARDLE, R. A., M.Sc., Professor Emeritus of Zoology, University of Manitoba, Winnipeg, Man.
1930—WASTENEYS, H., Ph.D., Professor Emeritus of Biochemistry, University of Toronto, Toronto, Ont.
1943—WYNNE, A. M., M.A., Ph.D., Professor and Head, Department of Biochemistry, University of Toronto, Toronto, Ont.
1940—WYNNE-EDWARDS, V. C., M.A., Professor of Natural History, Marsichall College, University of Aberdeen, Aberdeen, Scotland
1935—YOUNG, E. GORDON, M.Sc., Ph.D., D.Sc., Director of the Atlantic Regional Laboratory, National Research Council, Halifax, N.S.

CORRESPONDING MEMBERS

SECTION I

DE LACRETELLE, JACQUES, de l'Académie française, Paris.

SECTION II

SIEBERT, WILBUR H., M.A., 182 West Tenth Ave., Columbus, Ohio, U.S.A.

SECTION IV

WATTS, W. W., Imperial College of Science and Technology, London, England.

MEDAL AWARDS

MÉDAILLE PIERRE CHAUVEAU

(Founded 1952)

1952—PIERRE DAVIAULT
1953—B. K. SANDWELL, LL.D., D.C.L.
1954—GÉRARD MORISSET, B.A., LL.L.
1955—JEAN-MARIE GAUVREAU, D.Sc.Pol.
1956—VICTOR MORIN, B.A., LL.D., O.I.P., Ch. Grand'Croix de l'Ordre du Saint-Sépulcre de Jérusalem
1957—CLAUDE MELANÇON, D.ès S.

FLAVELLE MEDAL

(Founded 1925)

1948—MARGARET NEWTON, B.S.A., M.Sc., Ph.D.
1949—W. P. THOMPSON, M.A., Ph.D., D.Sc.
1950—C. H. BEST, C.B.E., M.A., M.D., D.Sc., F.R.C.P.(C), F.R.S., Hon. D.Sc.(Oxon.)
1951—WILDER G. PENFIELD, C.M.G., Litt.B., M.D., M.A., B.Sc., D.Sc., F.R.S.
1952—A. G. HUNTSMAN, M.D.

1953—E. G. D. Murray, O.B.E., M.A., L.M.S.S.A., M.D., D.Sc.
1954—D. A. Scott, M.A., Ph.D., F.R.S.
1955—C. S. Hanes, Ph.D., Sc.D., F.R.S.
1956—George Lyman Duff, M.A., M.D., Ph.D.
1957—T. W. M. Cameron, T.D., M.A., Ph.D., D.Sc., M.R.C.V.S.
1958—A. G. Lochhead, M.Sc., Ph.D.

HENRY MARSHALL TORY MEDAL

(Founded 1943)

1943—John L. Synge, M.A., Sc.D., F.R.S.
1944—Frank Allen, M.A., Ph.D., LL.D.
1945—Otto Maass, C.B.E., M.Sc., Ph.D., LL.D., F.R.S.
1946—John S. Foster, B.Sc., Ph.D., F.R.S.
1947—E. F. Burton, O.B.E., Ph.D.
1949—H. S. M. Coxeter, Ph.D., F.R.S.
1951—T. Thorvaldson, A.M., Ph.D., D.Sc., LL.D.
1953—G. Herzberg, M.A., Dipl.Ing., Dr.Ing., F.R.S.
1955—E. W. R. Steacie, O.B.E., M.Sc., Ph.D., D.Sc., LL.D., D. de l'U. F.R.S.
1957—C. S. Beals, M.A., D.I.C., Ph.D., D.Sc., F.R.S.

LORNE PIERCE MEDAL

(Founded 1926)

1948—Gabrielle Roy (Mme Carbotte)
1949—John Murray Gibbon, B.A., D. ès L.
1950—Marius Barbeau, LL.L., B.Sc., D. ès L., Dipl.Anth.
1951—E. K. Brown, B.A., D. ès L. (posthumously)
1952—Hugh MacLennan, M.A., Ph.D.
1953—Earle Birney, Ph.D.
1954—Alain Grandbois
1955—William Bruce Hutchison
1956—Thomas H. Raddall, LL.D.
1957—A. M. Klein
1958—H. Northrop Frye, M.A., Ph.D.

TYRRELL MEDAL

(Founded 1928)

1948—Le chanoine Lionel Groulx, Ph.D., D.Th., D. ès L.
1949—Reginald G. Trotter, M.A., Ph.D., D.C.L.
1950—John Bartlet Brebnee, M.A., B. Litt., Ph.D., Litt.D.
1951—Jean Bruchési, LL.L., D.Sc.Pol., D. ès L., and
D. G. Creighton, M.A., LL.D.
1952—C. B. Sissons, LL.D.
1953—Séraphin Marion, M.A., D. ès L.
1954—G. de T. Glazebrook
1955—C. P. Stacey, O.B.E., A.M., Ph.D.
1956—Mgr Olivier Maurault, C.M.G., P.D., LL.D., p.SS., D. ès L., D.C.L.
1957—George F. G. Stanley, M.A., B.Litt., D.Phil.
1958—W. L. Morton, B. Litt., M.A.

WILLET G. MILLER MEDAL

(Founded 1943)

1943—Norman Levi Bowen, M.A., Ph.D., Sc.D.
1945—Morley E. Wilson, Ph.D.
1947—F. H. McLearn, B.E., Ph.D.
1949—H. V. Ellsworth, M.A., Ph.D.
1951—J. E. Hawley, M.A., Ph.D.
1953—C. H. Stockwell, B.A.Sc., Ph.D.
1955—J. Tuzo Wilson, O.B.E., B.A., Sc.D., Ph.D. LL.D., D.Sc.
1957—J. E. Gill, B.Sc., Ph.D.

THE HARRISON PRIZE AWARD

(Founded 1957)

1957—R. G. E. Murray, M.A., M.D., C.M., and C. F. Robinow, M.D.

PRESIDENTS

1948-1949 . . . Gustave Lanctôt, D.ès L., LL.M., LL.D., D.Sc.Pol., C.R.
1949-1950 . . . Joseph A. Pearce, M.A., Ph.D., D.Sc.
1950-1951 . . . J. J. O'Neill, M.Sc., Ph.D.
1951-1952 . . . H. F. Angus, M.A., B.C.L., LL.D.
1952-1953 . . . G. B. Reed, O.B.E., M.A., B.Sc., Ph.D., LL.D.
1953-1954 . . . Jean Bruchési, LL.L., D.Sc.Pol., D. ès L.
1954-1955 . . . E. W. R. Steacie, O.B.E., Ph.D., D.Sc., F.R.S.
1955-1956 . . . G. S. Hume, O.B.E., Ph.D.
1956-1957 . . . W. A. Mackintosh, C.M.G., M.A., Ph.D., LL.D., D.C.L.
1957-1958 . . . T. W. M. Cameron, T.D., M.A., Ph.D., D.Sc., M.R.C.V.S.
1958-1959 . . . Pierre Daviault

LIST OF PRESIDENTS OF SECTIONS

SECTION I

1948-1949 . . . . . Léopold Houlé
1949-1950 . . . . . Le chanoine Georges Robitaille
1950-1951 . . . . . Donatien Frémont
1951-1952 . . . . . L'abbé Arthur Maheux
1952-1953 . . . . . Claude Melançon
1953-1954 . . . . . Gérard Morisset
1954-1955 . . . . . Jean Chauvin
1955-1956 . . . . . Eugène L'Heureux
1956-1957 . . . . . Jean-Marie Gauvreau
1957-1958 . . . . . Adrien Plouffe
1958-1959 . . . . . Maurice Lebel

SECTION II

1948-1949	B. K. Sandwell
1949-1950	A. G. Dorland
1950-1951	W. A. Mackintosh
1951-1952	A. S. P. Woodhouse
1952-1953	A. R. M. Lower
1953-1954	F. M. Salter
1954-1955	D. A. MacGibbon
1955-1956	J. S. Thomson
1956-1957	W. Kaye Lamb
1957-1958	F. H. Underhill
1958-1959	V. W. Bladen

SECTION III

1948-1949	J. S. Foster
1949-1950	C. S. Beals
1950-1951	H. G. Thode
1951-1952	Gerhard Herzberg
1952-1953	R. L. Jeffery
1953-1954	P. E. Gagnon
1954-1955	R. M. Petrie
1955-1956	W. H. Watson
1956-1957	H. S. M. Coxeter
1957-1958	Léo Marion
1958-1959	G. M. Shrum

SECTION IV

1948-1949	Victor Dolmage
1949-1950	T. L. Tanton
1950-1951	P. S. Warren
1951-1952	G. S. Hume
1952-1953	G. Hanson
1953-1954	T. H. Clark
1954-1955	J. B. Mawdsley
1955-1956	J. E. Hawley
1956-1957	H. C. Gunning
1957-1958	H. C. Rickaby
1958-1959	L. S. Russell

SECTION V

1948-1949	A. H. Hutchinson
1949-1950	T. W. M. Cameron
1950-1951	L. C. Simard
1951-1952	C. L. Huskins
1952-1953	W. A. Clemens
1953-1954	R. D. Gibbs
1954-1955	E. G. D. Murray
1955-1956	Georges Maheux
1956-1957	W. H. Cook
1957-1958	W. R. Campbell
1958-1959	N. H. Grace

ASSOCIATED ORGANIZATIONS

The Canadian Institute of Mining and Metallurgy

THE ROYAL SOCIETY OF CANADA

REPORT OF THE HONORARY SECRETARY FOR THE YEAR 1957–58

COUNCIL MEETINGS

The Council held four meetings during the year to conduct the affairs of the Society. The Report of Council presented to the annual meeting of the Royal Society of Canada contains a complete account of the year's business.

The Sections recommended the election of twenty-eight Fellows. Their names, and the Sections to which they were elected, appear under "Annual Meeting."

Three medals were awarded by the Society:

Flavelle Medal to Dr. A. G. Lochhead

Lorne Pierce Medal to Professor H. Northrop Frye

Tyrrell Medal to Professor W. L. Morton

(Citations are given on pages 43–6.)

The Council appointed a new Committee, consisting of Dr. W. Kaye Lamb as chairman, Dr. W. H. Cook, and M Pierre Daviault, to consider and recommend revisions in the Society's scholarship programme. The Committee's report was presented to the February meeting of Council. It pointed out that the National Research Council offers awards in the natural sciences, and that during the past year the Canada Council was established and is offering awards in the Arts, Humanities, and Social Sciences. These awards, however, normally go to scholars below the age of thirty-five. It was felt that the Society should furnish a type of assistance that neither Council is providing, and the Committee suggested that "Royal Society of Canada Awards" might be made to senior scholars, senior both in age and experience, for periods of three months to a year. Council approved these recommendations and the various provincial governments have been appealed to for support of the programme.

Only one Royal Society of Canada Scholarship was awarded for the academic year 1958–59 (Section I): a pre-doctoral scholarship to Roland Sansfaçon of Quebec City; he will carry on research at the Université de Poitiers in France.

During the past few years Rutherford Memorial Fellowships of $500 each were awarded to two successful candidates selected from among those awarded National Research Council Post-doctorate Overseas Fellowships. Since none of the applicants for Rutherford Fellowships for 1958–59 received National Research Council Fellowships, no Rutherford Memorial Award was made.

The Awards Committee was again asked to receive and screen applications for the third series of scholarships and fellowships offered by NATO. Fifty-seven applications were received, and, in accordance with instructions, ten of these were selected and forwarded to Paris, where the final selection was made by NATO's own Selection Committee. Dr. Raymond Klibansky of Montreal received one of the awards.

At the request of the Embassy of the Federal Republic of Germany, the Committee dealt with applications received for four scholarships offered to Canadians by the West German Government, tenable in Germany for the academic year 1958–59. The scholarships were awarded to the following: Lorene Batley of Peterborough, Robert Charles Culley of Toronto, John Douglas of Toronto, and Henry Walton of Ottawa.

The President, Dr. T. W. M. Cameron, presented the Diploma of Honorary Fellowship in the Royal Society of Canada to His Royal Highness Prince Philip, Duke of Edinburgh, on October 14, 1957, at Rideau Hall. The President was accompanied by the Honorary Secretary, Col. C. P. Stacey (Section II), Dr. Léo Marion (Section III), Dr. L. S. Russell (Section IV) and Dr. Charles Camsell (a past president). The Vice-President, M. Pierre Daviault, was unable to attend.

There were nine retirements: Arthur Saint-Pierre, Victor Morin, Section I; Henry Alexander, A. G. Dorland, Fred Landon, Herbert Marshall, Section II; D. L. Drayton, William Leach, C. C. Macklin, Section V.

ANNUAL MEETING

The annual meeting was opened in Convocation Hall, University of Alberta, at 10.00 A.M., June 2. The following Fellows registered:

UNATTACHED

Mackenzie, C. J.

SECTION I

Audet, Louis-Philippe; Daviault, Pierre; D'Eschambault, l'abbé Antoine; Lebel, Maurice; Lockquell, frère Clément; Lortie, Léon; Maurault, Mgr Olivier; Plouffe, Adrien; Sylvestre, Guy.

SECTION II

Alexander, W. H. (retired); Angus, H. F.; Bissell, C. T.; Bladen, V. W.; Britnell, G. E.; Clark, S. D.; Daniells, Roy; Easterbrook, W. T.; Ferguson, W. K.; Frye, H. Northrop; Helleiner, Karl F.; James, F. Cyril; Johnson, A. H.; Knox, F. A.; Lamb, W. Kaye; Long, M. H.; Longley, R. S.; Mc-

Gregor, M. F.; MacKenzie, N. A. M.; Macpherson, C. B.; Masters, D. C.; McIlwraith, T. F.; Morton, W. L.; Muckle, J. T.; Neatby, Hilda; Phelan, G. B.; Priestley, F. E. L.; Rose, W. J.; Sage, W. N.; Salter, F. M.; Stacey, Charles P.; Stanley, George F. G.; Stewart, Andrew.

Section III

Babbitt, J. D.; Beals, C. S.; Campbell, Alan N.; Derry, Douglas; Duckworth, H. E.; Field, G. S.; Gagnon, Paul E.; Gishler, P. E.; Hachey, H. B.; Haslam, R. N. H.; Heard, J. F.; James, R. D.; Jeffery, R. L.; Johns, M. W.; Jones, R. N.; Lang, R. J. (retired); Langstroth, G. O.; Lemieux, R. U.; LeRoy, D. J.; MacDonald, D. K. C.; Marion, Léo; Mason, S. G.; McCallum, K. J.; Middleton, W. E. K.; Niven, C. D.; Pearce, J. A.; Robson, J. M.; Rose, D. C.; Scherk, Peter; Shrum, G. M.; Smith, H. Grayson; Spinks, J. W. T.; Thomson, Andrew; Walker, O. J.; Williams, W. L. G.; Winkler, C. A.; Wyman, Max; Yaffe, Léo.

Section IV

Armstrong, J. E.; Armstrong, H. S.; Baird, D. M.; Boyle, R. W.; Byers, A. R.; Caley, J. F.; Derry, D. R.; Edmunds, F. H.; Folinsbee, R. E.; Frebold, Hans; Gunning, H. C.; Gussow, W. C.; Hage, Conrad O.; Hardy, R. M.; Hodgson, John H.; Hume, G. S.; Jacobs, J. A.; Jones, I. W.; Mathews, W. H.; Mawdsley, J. B.; Moore, E. S.; Okulitch, V. J.; Rickaby, H. C.; Robinson, S. C.; Russell, L. S.; Sproule, J. C.; Warren, H. V.; Warren, P. S.; Williams, M. Y.

Section V

Anderson, J. A.; Bailey, D. L.; Barr, M. L.; Black, E. C.; Cameron, T. W. M.; Campbell, W. R.; Clemens, W. A.; Collier, H. B.; Collip, J. B.; Cook, W. H.; Cormack, R. G. H.; Cowan, Ian McT.; Dauphinee, J. A.; Eagles, Blythe; Fisher, K. C.; Foerster, R. E.; Gibbs, R. D.; Gibbons, N. E.; Grace, N. H.; Haist, R. E.; Hart, J. L.; Hayes, F. R.; Heimburger, C. C.; Hoar, W. S.; Hopkins, J. W.; Huntsman, A. G.; Hutchinson, A. H.; Jaques, L. B.; Johnson, T.; Krotkov, G.; Ledingham, G. A.; Lochhead, A. G.; McCalla, A. G.; Moss, E. H.; Murray, E. G. D.; Murray, R. G. E.; Neatby, K. W.; Neave, Ferris; Needler, A. W. H.; Rawson, Donald S.; Rempel, J. G.; Ricker, W. E.; Senn, H. A.; Shaner, R. F.; Strickland, E. H.; Tarr, H. L. A.; Thompson, W. P.; Walker, E. M. (retired); Walker, Norma Ford.

The first general meeting was called to order by the President, Dr. T. W. M. Cameron, who welcomed the Fellows and their guests and expressed the gratitude of the Society to the University of Alberta for its

generosity in playing host to the Society. Dr. Andrew Stewart, President of the University of Alberta, welcomed the Fellows in the following words:

It is a particular pleasure to welcome the Royal Society to the University of Alberta in our Golden Jubilee Year. Your acceptance of our invitation does honour to the university and helps to mark our fiftieth anniversary.

The history of the University of Alberta parallels the history of the province. The province was formed in 1905—the University Act was passed in 1906. The university began operations in 1908, when Dr. H. M. Tory was appointed President on January 1 of that year. Classes started in September with a staff of four professors and forty-five students. It is a special pleasure to us that the original member of the staff and a member of your Society is present with us on this occasion, Dr. W. H. Alexander. The university started in the top floor of a school on the south side of the city. Today, if you visited the school and climbed to the attic, you would find a door with the word "President" on it. This marks Dr. Tory's office.

Like the province, the university had its early beginnings in the first decade of the twentieth century. It made a memorable contribution during the years of World War I, this contribution being marked by the tablets outside this hall and by the memorial organ in it. There was a period of growth and expansion in the early twenties; consolidation in the later twenties; stagnation during the drought and depression of the thirties; frustration during the Second World War; post-war veteran bulge, to which the remaining huts on the campus bear mute tribute; a second period of growth and expansion commencing in 1947 and accelerating from that date to bring on us what all universities now know as the "crisis of numbers." You will have an opportunity while you are here to see the physical achievements—I hope you will also have an opportunity to meet with members of our staff and to visit the departments and to see how we have grown in other and more important ways.

Mr. President, your Society, which has a long and distinguished record, has for its purposes the bringing together of men from many branches of learning, to promote the interests of the Arts, Literature, and the Sciences, for the welfare of Canada. We hope that during your visit here you will have all the opportunities you wish for the achievement of your objects, and that the arrangements made for your convenience and comfort will be satisfactory to you, so that you will wish to return here before another fifty years have elapsed.

The President thanked Dr. Stewart.

The President called for a motion to approve the minutes of the last Annual Meeting. It was moved by Dr. S. D. Clark, seconded by Dr. G. S. Hume, that the minutes be approved. CARRIED.

The President asked the sectional Presidents to introduce the new Fellows: L. Baudouin, M.-L. Beaulieu, J. Béraud, G. Gélinas, Frère Clément Lockquell, J.-P. Vinay, Section I; Kathleen Coburn, W. K. Ferguson, K. F. Helleiner, M. F. McGregor, C. B. Macpherson, Andrew Stewart, Section II; F. E. Beamish, J. F. Heard, M. W. Johns, D. K. C. MacDonald, W. T. Tutte, Léo Yaffe, Section III; D. M. Baird, J. A. Jacobs, R. J. Hardy, J. Humphrey Hodgson, Section IV; M. L. Barr, L. F. Bélanger, C. J. Bishop, A. M. Fallis, R. G. E. Murray, Norma Ford Walker, Section V.

The following citations were read by the Presidents of the Section:

SECTION I

Louis Baudouin est issu d'une famille chez qui la magistrature est une tradition établie depuis trois générations. Il était lui-même, en France, magistrat et professeur quand il vint au Canada pour enseigner le droit civil à l'université McGill. Son grand travail : *Le Droit civil de la province de Québec, modèle vivant de droit comparé* l'établit comme un maître de cette discipline. Ajoutons à cet ouvrage un volumineux *Traité pratique de la responsabilité en cas d'accident d'automobile*. M. Baudouin est un ancien président de la Section de droit comparé du Canadian Bar Association. Il a été rapporteur général de plusieurs congrès internationaux, professeur invité à l'université Columbia en 1957 et à l'université Tulane, Louisiane en 1958 et 1959. C'est un intellectuel remarquable dont la culture et l'esprit de recherche seront un apport précieux pour la Société royale du Canada.

Marie-Louis Beaulieu, par ses longues et minutieuses recherches, par son enseignement clair et méthodique, par ses livres (*Du bornage et de l'action en bornage* et *Les Conflits de droit dans les rapports collectifs de travail*) s'est taillé une place de premier choix comme juriste. Docteur en droit de l'université Laval, attaché à l'université de Poitiers (France), chargé de cours à la Faculté des sciences sociales et à la Faculté d'arpentage et de génie forestier de l'université Laval, Me Beaulieu est un collaborateur assidu à la *Revue du barreau*, à la *Revue légale*, aux *Rapports de faillites* et aux *Rapports de pratique* : c'est un universitaire dont le rayonnement est tout à l'honneur des humanités.

Jean Béraud a fait de solides études à Nicolet, à l'université Laval, à New York, puis à Paris. Par ses travaux il s'est mérité le Canadian Drama Award et le Prix David. Au journal *La Presse* depuis 1924, il est directeur des rubriques de théâtre, littérature, musique, et cinéma. Les principaux ouvrages qu'il a publiés sont *L'Initiation à l'art dramatique* (Figuière, Paris; Variétés, Montréal); *Variations sur trois thèmes*, en collaboration avec Marcel Valois et Léon Franque (Editions Pilon); quelques pièces en un acte. Comme témoignage de sa grande fécondité littéraire et de son travail tenace, il vient de publier, au Cercle du Livre de France, *350 Ans de théâtre au Canada français*. C'est un écrivain dont la culture et le prestige seront un apport précieux à la section des Humanités de la Société royale du Canada.

Gratien Gélinas est présentement directeur de la Comédie canadienne, vice-président de l'Union des Artistes et membre du Conseil des Arts de la ville de Montréal. Depuis un quart de siècle au moins, il a joué dans le domaine du théâtre un rôle de premier plan. De 1937 à 1940, il réalisa un programme radiophonique, « Le Train de Plasir » au cours duquel fut créé le personnage bien connu de Fridolin. De 1938 à 1945, il préparait des revues qui connurent des succès retentissants. En 1948, il créait, à Montréal, la pièce *Ti-Coq* qui eut 200 représentations, record qui n'a pas encore été

dépassé. Cette pièce fut jouée à Toronto, Chicago, New York, et Montréal; en 1950, elle paraissait chez Beauchemin et l'année suivante on en faisait un film. En 1949, M. Gélinas obtenait le grand prix de la Société des Auteurs dramatiques et un doctorat ès lettres *honoris causa* avec thèse de l'université de Montréal. C'est un artiste dont la culture et le rayonnement constitueront un enrichissement pour la Société royale du Canada.

Le Frère Clément Lockquell est docteur en philosophie de l'université Laval et doyen de la Faculté de Commerce de la même institution. C'est un universitaire de haute culture, un critique littéraire dont les appréciations sont recherchées et le jugement fort sûr, doublé d'un romancier à l'occasion et qui nous a donné *Les Elus que vous êtes*. Il appartient à une communauté vouée à l'enseignement et qui a donné à la Société royale l'un de ses membres les plus illustres et les plus actifs, le regretté Frère Marie-Victorin dont il suit les traces et prolonge le rayonnement dans un autre champ d'activité, non moins important pour la nation canadienne. Clément Lockquell est un intellectuel de grande classe dont la vaste culture honore le Canada.

Jean-Paul Vinay est professeur et directeur de la section de linguistique à la faculté des lettres de l'université de Montréal. Dans notre pays bilingue, son œuvre scientifique est d'une extrême importance. Auteur de nombreux articles techniques sur la linguistique générale et française ainsi que de plusieurs ouvrages didactiques sur la grammaire, la linguistique des langues indo-européennes et la stylistique comparée du français et de l'anglais, il a participé, comme expert conseil auprès de l'OACI, à l'élaboration d'un alphabet international d'épellation pour les communications aériennes; il est directeur du Centre de Recherches lexicographiques de l'université de Montréal pour l'élaboration du Dictionnaire bilingue canadien, en collaboration avec MM. Pierre Daviault et Alexander. Il est l'auteur d'une quinzaine d'ouvrages de linguistique fort appréciés.

Section II

Kathleen Coburn, a graduate of the universities of Toronto and Oxford, has been a member of the English staff of Victoria College in the University of Toronto since 1928. She has devoted herself primarily to the study of Samuel Taylor Coleridge and is now internationally known for her scholarship and in particular for the new mass of Coleridge material that she has brought to light. She has published *Coleridge's Philosophical Works* (1949), *The Inquiring Spirit* (1951), *The Letters of Sara Hutchinson 1800–1835* (1954), and, in 1957, the first two volumes covering the years 1794–1804 of a collection which will eventually run to some ten volumes of Coleridge's Notebooks. In her spare moments she has also dashed off a novel, *The Grandmothers*. She has twice held a Guggenheim Fellowship and is a Fellow of the Royal Society of Letters.

Wallace Klippert Ferguson, a graduate of the University of Western Ontario, took his doctorate in history at Cornell, and was a member of the

History Department in New York University from 1928 to 1956. We are delighted to welcome him back to Canada in the position which he has held since 1956 as Head of the Department of History in his Alma Mater of Western Ontario. His principal publications have been *Erasmi Opuscula* (1933); *The Renaissance* (1940); *The Renaissance in Historical Thought* (1948); as well as *A Survey of European Civilization* (written in collaboration with Geoffrey Brunn), first published in 1936 and republished in frequent new editions since then. He held a Guggenheim Fellowship in 1939.

Karl Ferdinand Mario Helleiner, a Ph.D. of Vienna and an archivist in Austria before World War II, has been on the staff of the University of Toronto since 1939 in the Department of Political Economy. He has made for himself a distinguished record as a teacher of economic history and has been the author of many articles in scholarly journals. He was selected to write the demographic chapter for the *Cambridge Economic History*; its excellence and originality can be presumed from the preview in his article on the demographic revolution in the *Canadian Journal of Economics and Political Science*. He has edited a volume of *Readings in European Economic History* for which he wrote a distinguished introduction.

Malcolm F. McGregor, a graduate in classics of the University of British Columbia with a doctorate from the University of Cincinnati, was a member of the classics staff at Cincinnati from 1933 to 1954. He is now Chairman of the Department of Classics in the University of British Columbia. He was responsible, with B. D. Meritt and H. T. Wade-Gary, for *Athenian Tribute Lists* in four volumes, which gave him an international reputation. He and his co-authors received the Award of Merit from the American Philological Society. He was a Guggenheim Fellow in 1948, and has written many articles in scholarly journals.

Crawford Brough Macpherson, a graduate of the University of Toronto with a doctorate from London, has been a member of the Department of Political Economy at Toronto since 1935, becoming a professor in 1956. His special field is political thought, on which he has written many articles. He has been a member of the Executive Council of the International Political Science Association since 1952. In Canada he is best known for his book on the Social Credit movement in Alberta—*Democracy in Alberta: the Theory and Practice of a Quasi-Party System* (1953)—an original and unorthodox contribution to the Canadian discussion of political parties. He held a Nuffield Fellowship in 1952.

Andrew Stewart, a graduate of the University of Manitoba in agriculture, did graduate work at Edinburgh, and was appointed to the Department of Economics in the University of Alberta in 1935. He became professor in 1946, Director of the School of Commerce in 1948, and President of the University in 1950. He is the author of many articles on agricultural economics, and has served on three royal commissions: the provincial Royal Commission on Natural Gas, the federal Royal Commission on Canada's Economic Prospects (the Gorden Commission); and the federal Royal Commission on Price Spreads, of which he is chairman.

Hilda Neatby, (elected in 1957), a graduate of the University of Saskatchewan, has been a member of the Department of History since 1934 and is now Head of the Department. After a year's work in French studies at the Sorbonne she completed her doctorate in the University of Minnesota, working under one of our most distinguished Canadian academic exports to the United States, Professor A. L. Burt, and producing the volume *The Administration of Justice under the Quebec Act* (1937). In 1949–51 she was a member of the Massey Commission on National Development in the Arts, Letters, and Sciences, to whose *Report* we owe the Canada Council. In 1953 her book, *So Little for the Mind*, an indictment of Canadian education, published several years before the first Russian Sputnik, achieved the impossible by stirring up a lively general interest in our Canadian schools and provoking what she has since charitably called, in her latest volume of addresses, *A Temperate Dispute*.

Section III

Fred Earl Beamish, B.A., M.A. (McM.), is Professor of Chemistry at the University of Toronto. He has done exceptional work in the field of analytical chemistry for which he has received international recognition. He is distinguished for his studies of the separation of the metals of the platinum group, and for his contributions as a teacher. During World War II Professor Beamish placed his specialized knowledge at the disposal of the Chemical Warfare Establishment, and rendered outstanding service.

John Frederick Heard, B.A. (West.), M.A., Ph.D. (McG.), Ph.D. (Lond.), is Professor and Head of the Department of Astronomy, University of Toronto, and Director of the David Dunlap Observatory. He is known for his application of spectroscopy to the field of astrophysics. He is distinguished not only for his statistical studies of the motions of large numbers of stars, but also for his studies of the relative motions of the components of binary systems, and his investigations of the motions which take place within the extended atmospheres of Novae and other peculiar emission line stars.

Martin Wesley Johns, B.A., M.A. (McM.), Ph.D. (Tor.), is Professor of Physics at Hamilton College, McMaster University. He is known for his important contributions in the field of β- and γ-ray spectroscopy. He and his students have built the first Siegbahn-type double-focusing β-ray spectrometers. With this instrument he has been able to establish the decay schemes for a number of radio-active nuclei. Dr. Johns has also been an active member of a medical research team interested in the detection and treatment of thyroid disorders.

D. K. C. MacDonald, M.A. (by decree, Oxon.), M.A.(Honours), Ph.D. (Edin.), D.Phil.(Oxon.), F.R.S.E., is a member of the Division of Pure Physics, National Research Council, and Honorary Chairman of the Department of Physics, University of Ottawa. He is distinguished for his contributions both to the experimental and theoretical study of thermal and

electrical properties of metals and solids. His experiments, particularly at the lowest temperatures, have revealed notable discrepancies with existing theory, for example, in the thermoelectric and galvanomagnetic behaviour of metals. Apart from this field of study he has investigated electrical fluctuations in resistances and other electronic devices, and has dealt with the theoretical aspects of these investigations. He is also responsible for general theoretical work on random processes, afterwards applied by other workers to ionospheric phenomena.

William Thomas Tutte, B.A., M.A., Ph.D. (Cantab.), is an Assistant Professor of mathematics at the University of Toronto. He is distinguished for his contributions to the theory of "graphs." He has solved the problem of dissecting a square into unequal squares. Some of his papers deal with the factorization of a graph, and with the four-colour problem. More recently he has become interested in the deeper algebraic and geometrical aspects of graph theory. Dr. Tutte is amongst the half dozen most distinguished mathematicians in his field.

Léo Yaffe, B.Sc., M.Sc. (Man.), Ph.D. (McG.), is Associate Professor of Chemistry and Director of the Radiological Laboratory, McGill University. He is one of the outstanding radiochemists on this continent, and is distinguished for his contributions to the chemistry of fission products. He is particularly well known for his method of determination of absolute disintegration rates by $4\pi\beta$ counting, and for his determination of yields of fission products formed in low energy and high energy fission of thorium and uranium.

Section IV

John Humphrey Hodgson is a geophysicist, a specialist in seismology. His experience in the field for oil companies, in teaching at the University of Toronto, and in research on the staff of the Dominion Astronomer has culminated in his appointment as Chief of the Division of Seismology of the Dominion Observatories. He is particularly well known for his work on the direction of faulting as related to earthquakes. Recognition of his work is found in his appointments as a director of the Seismological Society of America and as Chairman of a Canadian committee of the International Union of Geodesy and Geophysics.

John Arthur Jacobs is a mathematician who has applied his talents with conspicuous success in the fields of geomagnetism, geothermometry, glaciology, and in studies of the interior of the earth. His ability as a scientist is matched by his success as a teacher. In five years during the war he rose to be Deputy Training Commander in the Royal Navy. Subsequently he lectured at the University of London, emigrated to Canada to lecture at the University of Toronto, and is now at the University of British Columbia. His appointments as a young man to committees of the National Research Council and International Societies are recognition of his ability and initiative.

David McCurdy Baird has combined the practice of geology as Provincial Geologist of Newfoundland, with teaching the science, first at the University of New Brunswick and latterly as Chairman of the Department of Geology at Memorial College. Although much of his work has been concerned with the geology of specific areas, most of his reports contain significant contributions to the science as a whole. In this day of specialization, he is a welcome exemplar of those increasingly rare geologists whose fundamental conclusions are based primarily on their own field work. He writes with equal lucidity for the professional geologist and for the general public.

Robert MacDonald Hardy as Dean of Engineering in the University of Alberta has earned wide recognition in the field of education. With less formality he might also be described as dean of the soil scientists of Canada. He is an internationally-known authority on soil mechanics, particularly in those areas where permafrost and muskegs are prevalent. His pioneer work in this field has been a notable contribution to the successful design of roads and airports in western Canada. His ability as a scientist and scholar is recognized in his appointments as a member of the Royal Commission on Energy and as Deputy Chairman of the Technical Advisory Committee of the Research Council of Alberta.

William Henry Mathews (elected in 1957), is a geologist whose exceptionally wide interests include glaciology, vulcanology, petrology and petrography, and soil and snow mechanics. In each of these fields he has made original and significant contributions as more than thirty publications attest. Of these, the glacial map of British Columbia, the geology of the Sheep Creek Camp, his studies of vulcanology on Mount Garibaldi, and work on determination of the composition of fine-grained igneous rocks are representative of the scope of his interests. He is a fellow or member of eight learned societies and has been appointed to six national or international scientific committees.

Section V

Murray L. Barr, B.A., M.D., M.Sc., Professor and Head of the Department of Microscopic Anatomy, University of Western Ontario, is distinguished for his work in cytology and congenital errors of sex development. He discovered a sexual dimorphism in mammalian somatic cells consisting of the presence of sex chromatin in female cells only. He introduced cytological tests of chromosomal sex which make it possible to determine whether intermitotic nuclei contain the female XX–, or the male XX–, sex chromosome complex. Applying this principle to man, he has contributed to an understanding of the pathogenesis of various errors of sex development, notably gonadal dysgenesis, hermaphroditism, and testicular dysgenesis. He has contributed to the knowledge of pathogenesis of teratomatous tumours, the freemartin condition in cattle, and various aspects of neurocytology.

Leonard Francis Bélanger, B.A., M.D., M.A.(Med.Sc.), joined the staff of the University of Ottawa in 1948 where he is now Head of the Department of Histology and Embryology. One of the outstanding histologists in Canada, Dr. Bélanger has introduced precise and reproducible techniques in the field of histology; a new method of phosphatase detection; localization of cholinesterase in the central nervous system and motor endplates of muscle; the integrated radio-autographic technique. Major investigations which Dr. Bélanger has carried out with this latter technique are: bone formation, tooth formation synthesis of polysaccharides, and the role of carbohydrates in the structure and function of the ear.

C. J. Bishop, B.Sc., Ph.D., is superintendent of the Dominion Experimental Farm at Kentville, Nova Scotia, and also Research Professor of Genetics at Acadia University. Dr. Bishop's major contributions to botany are in the field of cytogenetics. He has made fundamental studies on the effects of x-radiation on cytoplasmic streaming and on the chromosomes of *Tradescantia*. He has analysed these effects in the mitotic cycle in pollen grains and shown the greatest sensitivity to be in the metaphase-anaphase period. He has compared the effect of polyploidy on such sensitivity. Dr. Bishop has extended these studies to mutations induced by neutron and x-radiations in the apple. He has established this technique as a new source of genetic mutants in practical horticulture.

A. Murray Fallis, B.A., Ph.D., is concerned chiefly with the taxonomy, life history, and pathological effects of parasites. As Professor of Parasitology at the University of Toronto, he is in charge of the training of both graduate and undergraduate students in parasitology. In both capacities Dr. Fallis has made and is making very significant contributions in this important field of biology. In many scientific publications he has reported the results of his researches on a wide variety of parasitic animals. Among these his work on blood parasites has been outstanding. Dr. Fallis is now on an expedition in Central America and could not be reached in time for this meeting. I therefore move that he be received *in absentia*.

Robert George Everitt Murray, B.A., M.A., M.D., L.M.C.C., was first appointed in 1945 as Lecturer in the Department of Bacteriology and Immunology at the University of Western Ontario and quickly rose to positions of increasing responsibility until in 1949 he became Professor and Head of that Department. Research-minded to an unusual degree, and possessing wide scientific vision, Dr. Murray has brought distinction to himself through his basic studies on the cell structure of bacteria. Special reference may be made to his comparative studies of the cytology of bacteria of different generic groups and his notable work on the cytological effects of infection of bacteria with bacteriophage. He has contributed in an outstanding degree to the methodology for differentiating the components of the bacterial cell and in the use of electron microscopy for elucidating the cell structure and composition of micro-organisms.

Norma Ford Walker, B.A., Ph.D. (Associate Professor of Human Gene-

tics and Director of the Department of Genetics, Hospital for Sick Children, Toronto), has made extensive studies in the life history and behaviour of insects, especially in the case of (1) *Grylloblatta*, a remarkable primitive insect of the Canadian Rocky Mountains, where she collected the bulk of the material now available for study; and (2) a flesh-fly, *Wohlfahrtia vigil*, which is responsible for a skin eruption in infants and young animals. Later work in the field of genetics included studies of the Dionne quintuplets. She is at present engaged entirely with problems concerning human heredity, such as the diagnosis and inheritance of twinning, the use of the Twin Method in human genetics, the inheritance of finger, palm, and sole patterns and their use in studies of disturbed foetal growth, as in Mongolism. Dr. Walker also directs considerable research by graduate students in the field of human genetics.

Those present were formally presented to the President of the Society by the Presidents of the Sections. They received diplomas and signed the Charter Book. Dr. Hilda Neatby, Section II, Dr. W. H. Mathews, Section IV, and Dr. H. L. A. Tarr, Section V, who had been elected in 1957, and Professor E. H. Strickland, Section V, elected in 1953, also received diplomas and signed the Charter Book. The following were absent: L. Baudouin, M. L. Beaulieu, J. Béraud, G. Gélinas, J. P. Vinay, Section I; Miss K. Coburn, Section II; F. E. Beamish, W. T. Tutte, Section III; and L. F. Bélanger, C. J. Bishop, and A. M. Fallis, Section V.

The Honorary Secretary presented the Report of Council, which was referred to the Sections.

The following proposed amendments to the by-laws were read by the President and approved unanimously:

That By-law 8 (9) (under "Council") be amended by deleting "the Chairman of the Canadian Government Overseas Awards Committee" and substituting "The Chairman of the Royal Society of Canada Awards Committee."

That By-law 9 (2)(*c*) (under "Duties of Fellows") be amended by deleting "a single railway coach fare . . . minus $5.00" and substituting "a single railway coach fare . . . minus $10.00."

That By-law 10 (4)(*a*) (under "Standing Committees") be amended by deleting "Canadian Government Overseas Awards" and substituting "Royal Society of Canada Awards."

Dr. Cameron asked the Secretaries of the Sections to prepare and submit a statement of all expenditures in writing with a copy for the Honorary Treasurer, in order that the annual budget may be prepared by the Treasurer for presentation to the February meeting of Council.

The meeting was adjourned at 11.00 A.M.

Sectional meetings were held on the 2nd, 3rd, and 4th of June. From 2 P.M. to 5 P.M. on Tuesday, June 3rd, the public was invited to hear the general symposium on the topic "The Potentialities of the Northwest."

A reception by the University of Alberta was held on Monday, June 1st, at 5.15 P.M., followed by a banquet for Fellows and wives. At this banquet, Dr. C. J. Mackenzie presented an address on "The Potentialities of the Northwest."

On Tuesday evening at 7 P.M., the Government of Alberta gave a dinner in the dining room of the Macdonald Hotel to Fellows and their wives. The Hon. Anders Aalborg, Minister of Education, welcomed the Society. He presented the compliments and regrets of the Lieutenant-Governor, the Hon. Dr. John James Bowlen, at being unable to attend the dinner because of illness. At this reception medals were presented to this year's winners, and the President gave his address entitled "Evolution of Evolution."

The second general meeting of the Society was held at 4 P.M., Wednesday, June 4th.

It was moved by Dr. J. A. Pearce, seconded by Dr. A. Plouffe, that the Report of Council be adopted. CARRIED.

The Report of the General Nominating Committee was read by Col. C. P. Stacey. The following officers were elected: President, Pierre Daviault; Vice-President, H. G. Thode; Honorary Secretary, C. P. Stacey; Associate Honorary Secretary, Guy Sylvestre; Honorary Treasurer, N. E. Gibbons; Honorary Editor, G. W. Brown; Honorary Librarian, W. Kaye Lamb. It was moved by Dr. N. H. Grace, seconded by Dr. W. R. Campbell, that the Report of the General Nominating Committee be adopted. CARRIED.

M. Pierre Daviault took the Chair and expressed his appreciation of the honour which the Society had paid him in electing him to the Presidency.

Reports were received from the Sections. It was moved by Dr. N. E. Gibbons, seconded by M Guy Sylvestre, that the accounts of the Royal Society be audited again next year by the firm of Ross, Touche & Co., chartered accountants. CARRIED.

M. Pierre Daviault expressed the thanks of the Society to:

The outgoing President and Council for the excellent way in which they had conducted the affairs of the Society in 1957–58.

Dr. T. W. M. Cameron expressed the thanks of the Society to:

Dr. Andrew Stewart, President of the University of Alberta, and to the University of Alberta for their kindness in affording the Society the facilities of the University for this meeting and for the wonderful reception and banquet offered to the Fellows and their wives.

The Local Committees (Dr. M. H. Scargill, Chairman, Dr. R. G. Baldwin, Public Relations) for their co-operation in arranging all matters pertaining to the meetings.

The Government of Alberta for the excellent dinner provided on Tuesday evening.

The Ladies' Committee (Mrs. W. H. Johns, Chairman).

The C.B.C. for recording the symposium and broadcasting parts of it.
Dr. N. H. Grace and Dr. F. M. Salter who acted as Liaison Officers.
The Executive Secretary.

The meeting was adjourned at 5 P.M.

M. Daviault invited the new Council to meet at once in the Council Chamber, Students' Union Building, University of Alberta.

PRESENTATION OF MEDALS

Flavelle Medal

Allan Grant Lochhead

Mr. President:

Dr. Allan Grant Lochhead began his scientific career at McGill University and graduated with honours in chemistry in 1911. He was awarded a Master of Science degree by the same institution in 1912. A few months thereafter he was enrolled in the University of Leipzig. The requirements for the degree of Doctor of Philosophy were completed just as war broke out. The next four years were devoted to studying and teaching in the famous, or rather infamous, civilian prisoners' camp at Ruhleben. Upon his return to Canada in December, 1918, he was appointed Lecturer in Bacteriology at Macdonald College and, on the basis of his work at Leipzig, he was awarded the degree of Doctor of Philosophy by McGill University in 1919.

In 1923, after three years of chemical and bacteriological work with industry and one year at the University of Alberta, where he was associated with Dr. J. B. Collip, Dr. Lochhead was named head of the newly created Division of Bacteriology in the Dominion Department of Agriculture. Here, after engaging very successfully in a variety of research problems, he dedicated himself to studies of soil bacteria. The results of his work in this field, extending over a period of nearly forty years, reveal a pattern of progress possible only for one with rare gifts of intellect and perseverance.

Dr. Lochhead is author or co-author of over eighty scientific papers. Notwithstanding significant work in several branches of bacteriological research, his reputation has been established mainly through his studies on soil-inhabiting bacteria. His work on classification, based on nutritional characteristics, is a monument of which he may well be proud. This he extended to comparative studies of forms inhabiting the rhizosphere and those living in soil remote from plant roots. This work was followed by studies on the selective stimulation of certain forms by plant roots, and by investigations of the production of antibiotics, vitamins, and other growth factors by various species.

Last year a special issue of the *Canadian Journal of Microbiology* was published in Dr. Lochhead's honour and was dedicated to him. The 312 pages are devoted to thirty research papers written by bacteriologists in eleven different countries.

Three years ago Dr. Lochhead relinquished his position as Chief of the Bacteriology Division. However, he is pursuing his researches as vigorously as ever. His skill as a research director is evidenced by the work of his colleagues and the qualities of the men and women attracted to his laboratory.

Mr. President: Section V is proud to present Dr. Allan Grant Lochhead as the Flavelle Medallist of 1958.

K. W. NEATBY

LORNE PIERCE MEDAL

Northrop Frye

MR. PRESIDENT:

I have the honour to present to you for the Lorne Pierce Medal Professor Northrop Frye, Chairman of the Department of English in Victoria College, in the University of Toronto.

Among Canadian literary scholars Professor Frye has won a unique place for himself during the last ten or a dozen years through his work in literary criticism. While he has occupied himself a good deal in the field of Canadian literature—including the publication of a volume on his old teacher, Pelham Edgar, and work done as chairman of the editorial board of the *Canadian Forum*—it is not for work of this specifically Canadian nature that he is chiefly famous. He is known throughout the English-speaking world as a literary critic dealing with themes which are of universal interest; uncovering, analysing, and criticising, with a sensitive subtlety, the symbols and myths in literary writing which so fascinate the twentieth-century mind.

His first main work—*Fearful Symmetry: A Study of William Blake*, published in 1947, gave him an international reputation. One proof of this in late years has been the frequency with which Harvard and other great American universities have made use of his services as a visiting professor. If he persists in remaining a Canadian, his persistence is certainly not due to the fact that his Canadian virtue has not been exposed to American temptation.

As all who have heard him or read him can testify, his wide popularity as a lecturer and teacher has not been due to any concessions he ever makes to the intellectual weakness or laziness of his audiences. A fine example of the high standards which he always maintains was the Convocation address which he gave last year when receiving an honorary degree from Carleton University, a beautifully written essay on "Culture and the National Will," now beautifully printed by Carleton University. "In his hands," as one of his fellow literary critics declared when presenting him for the Carleton degree, "literary criticism is a tough and subtle discipline of the mind, a creative synthesis by which light is shed on both the work of art and on human nature and destiny."

Last year, 1957, his second great work—*Anatomy of Criticism*—appeared. This aims at providing a conceptual framework for literary discussion in the realm of pure criticism. It is an attempt to establish "a coherent and comprehensive theory of literature, logically and scientifically

organized." The author's immense learning, his thoroughness and his delight in classifications result, as one commentator has put it, in "a virtuosity of analysis and cross-reference that must leave most readers breathless." A mere historian can only report that he has been dazzled by the brilliant and witty insights which the author scatters through his pages, and made humble by the discovery of how much human experience is beyond the range of his own comprehension. When he reads reviews of the Frye work by literary specialists he is impressed by the obvious deference and sense of awe with which they approach the author. And he suspects that it will be some time before the full contents of this volume have been digested properly by Professor Frye's literary colleagues. With this feeling of breathlessness and awe I present Northrop Frye for the Lorne Pierce Medal.

F. H. UNDERHILL

TYRRELL MEDAL

William Lewis Morton

MR. PRESIDENT:

I have the honour to present to you for the Tyrrell Medal William Lewis Morton, professor of Canadian History in the University of Manitoba.

Professor Morton may be taken as in a special sense an intellectual representative of his native province of Manitoba. Last year, when he published his history of the province—*Manitoba: A History*—he dedicated it "To My Mother and Father, Manitobans, and My Children, Manitobans." He was born in the province, received his early education in its schools and university; and, after a period as Rhodes Scholar at Oxford, he came back to teach history in the University of Manitoba, where he held junior positions in St. John's College, United College, and Brandon College before settling down in the History Department of the University itself, of which he has been Chairman since 1950. His historical writing has been centred mainly upon his native province. And in this field he has produced a body of work which is distinguished for the high quality of its research scholarship, for the skill of the author in bringing out the philosophical implications of the political or academic issues with which he has had to deal, and for the spirit of loving sympathy in which he broods over his community, its successes and its failures.

I select for citation, as justifying the award of the Tyrrell Medal, four historical volumes centring about this theme of Manitoba: *The Progressive Party in Canada* (1950), the first volume to be published in the series Social Credit in Alberta, its background and development; *Alexander Begg's Red River Journal and Other Papers Relative to the Red River Resistance of 1869–1870* (1956), a volume edited for the Champlain Society with an introduction by Professor Morton which is an acute and

subtle analysis of the events of 1869–70 that led to the creation of the province of Manitoba; *One University: A History of the University of Manitoba, 1877–1952* (1957); and *Manitoba: A History* (1957).

All of these volumes deal with highly controversial subjects. As Professor Morton has said himself in his history of the province, Manitoba is a truly plural society, and it is here that the Canadian experiment in political bi-nationalism and cultural plurality is at its most intense. His analysis of these various controversies is notable for the clarity with which it presents the various conflicting points of view and for its shrewdness and general fairness of judgment. In his study of the Progressive party, with its internal struggles between "Manitobans" and "Albertans," he has given us enlightening insights into the working of party politics in Canada. His history of the province is remarkably successful in weaving together the story of agricultural settlement, of the mingling of ethnic stocks and cultures, and of the intricate interplay between provincial and federal politics. My own local Ontario prejudices lead me to feel that he has perhaps been unduly severe upon the defects of the qualities of the Ontario Grit farmer settlers who upset the arrangements of 1870; and my effete eastern Canadian cynicism causes me to smile at the frequent revelations of the somewhat bitter sorrow of the Manitoba historian that his province never realized its more imperial ambitions of becoming a major power like Ontario and Quebec. But the Morton body of work on Manitoba stands out as a model for the kind of work that, for the most part, still needs doing in the other provinces, and makes him one of our leading Canadian historians.

F. H. UNDERHILL

REPORTS OF SECTIONS

Rapport de la Section I

La Section I a tenu quatre réunions auxquelles ont assisté neuf sociétaires : MM. Louis-Philippe Audet, Pierre Daviault, Abbé Antoine d'Eschambault, Maurice Lebel, Frère Clément Lockquell, é.c., Léon Lortie, Mgr Olivier Maurault, Dr Adrien Plouffe, et Guy Sylvestre.

La Section I a consacré quatre séances à la discussion des affaires courantes et elle a pris connaissance de neuf travaux préparés par les confrères présents a l'assemblée annuelle ou par d'autres confrères qui avaient adressé le texte de leur étude. Nous avons participé en outre au colloque tenu par les Sections I et II, de même qu'à celui qui groupait toutes les sections et dont le thème était les possibilités du Nord-Ouest canadien. Outre les membres de la Section, deux invités ont assisté à l'une de nos séances d'études.

Nous avons eu à déplorer la perte, cette année, de l'un de nos sociétaires, M. Cyrille-F. Delâge. D'autre part, nous avons accueilli six nouveaux membres : MM. Louis Baudouin, Marie-Louis Beaulieu, Jean Béraud, Gratien Gélinas, Frère Clément Lockquell, é. c., Jean-Paul Vinay.

Le rapport du Conseil fut approuvé.

Les élections ont donné les résultats suivants :

Président : Maurice Lebel
Vice-président : Léon Lortie
Secrétaire : Louis-Philippe Audet
Représentant supplémentaire au Conseil : Jean-Marie Gauvreau
Comité de nominations : Maurice Lebel, Dr Adrien Plouffe
Comité de la Médaille Chauveau : Maurice Lebel, Jean-Marie Laurence, Léon Lortie, Robert Elie, Jean-Marie Gauvreau, Raymond Douville, Louis-Philippe Audet
Comité de la Médaille Lorne Pierce : Maurice Lebel, Robert Elie, Guy Sylvestre
Comité de la Médaille Tyrrell : Maurice Lebel, Antoine Roy, Mgr Olivier Maurault
Comité des candidatures : Maurice Lebel, Donatien Frémont, Jean-Charles Bonenfant, Léon Lortie, Guy Sylvestre, R.P. Louis-Marie Régis, Jean-Marie Gauvreau, Dr Adrien Plouffe, Louis-Philippe Audet
Comité des bourses : Maurice Lebel, Jean Bruchési, Robert Gauthier, R.P. Louis-Marie Régis, o.p., Louis-Philippe Audet
Comité du programme : Léon Lortie, R. P. Emile Legault, c.s.c., Louis-Philippe Audet
Comité des projets : Léon Lortie
Comité des publications : Louis-Philippe Audet, Guy Sylvestre
Editeur : Louis-Philippe Audet

Il est proposé par Louis-Philippe Audet, appuyé par Léon Lortie, que le rapport de la Section I soit adopté.

Report of Section II

Section II held two business meetings, two general sessions, one joint session with Section I, and participated in the general symposium on the potentialities of the Northwest. Thirty-two Fellows attended and there were many visitors. The Section noted with deep regret the absence of its President, Professor F. H. Underhill, because of illness. The Secretary of the Section was instructed to telegraph Professor Underhill expressing its hope for his speedy recovery and its warm appreciation of his presidential address.

The following officers were elected:

President: V. W. Bladen
Vice-president: G. B. Phelan
Secretary: George F. G. Stanley
Additional member of Council: R. Daniells
Editorial Committee: Hilda Neatby (*Chairman*), M. F. McGregor, G. A. Elliott, F. E. L. Priestley, George F. G. Stanley
General Nominating Committee: J. A. Corry, George F. G. Stanley
Medal Committees: *Chairman*: Pierre Daviault
Lorne Pierce Medal: V. W. Bladen, G. B. Phelan, M. M. Ross
Tyrrell Medal: V. W. Bladen, G. B. Phelan, W. L. Morton
Advisory Committee (*New Fellows*): G. B. Phelan (*Chairman*), V. W. Bladen, George F. G. Stanley, R. S. Longley, F. R. Scott, H. B. Hawthorn, F. M. Salter
Programme Committee: V. W. Bladen (*Chairman*), Hilda Neatby (*Vice-Chairman*), M. F. McGregor, G. A. Elliott, F. E. L. Priestley, George F. G. Stanley

The Report of Council was approved.

The Section noted with deep regret the deaths of His Honour E. Fabre Surveyer, Rev. A. J. Denomy, and Professor Chester Martin.

It noted the transfer to the retired list of Henry Alexander, Fred Landon, A. G. Dorland and Herbert Marshall.

It was moved by S. D. Clark, seconded by V. W. Bladen, that this report be adopted.

Report of Section III

The Section held two business meetings and the scientific sessions as listed in the programme.

The following officers were elected:

President: G. M. Shrum
Vice-president: G. de B. Robinson

Secretary: A. D. Misener
Additional Member of Council: Léo Marion
Tory Medal Committee: G. Herzberg (*Convener*), O. Maass, H. S. M. Coxeter, J. S. Foster, C. S. Beals
Committee for the Selection of New Fellows: Officers of the Section plus P.-A. Giguère, H. G. Thode, A. McKellar
Sectional Editorial Committee: W. H. Watson, T. Thorvaldson, G. de B. Robinson
Members of the General Nominating Committee: G. M. Shrum, G. de B. Robinson
Committee for Award of Royal Society Research Fellowships: P.-A. Giguère, B. W. Currie, Helen S. Hogg, D. C. Rose
Programme Committee: Officers of the Section, with power to add
Representative on the C.I.C. Medal Committee: H. G. Thode
Representative on the Canadian National Committee of the International Union of Pure and Applied Chemistry: A. N. Campbell
Representative on the Canadian National Committee of the International Union of Pure and Applied Physics: H. E. Duckworth
Representatives on the Editorial Board of the Canadian Journals of Research: H. E. Duckworth, D. J. Le Roy
Representatives on the Canadian National Committee of the International Astronomical Union: B. W. Currie, Helen S. Hogg, G. Herzberg

Discussions took place of the plan being studied by the Canadian Association of Physicists for the building of a high-energy nuclear physical laboratory in Canada. The C.A.P. proposes to ask the Government, through the appropriate channels, to build such a laboratory. The Section decided to endorse such a proposal, and to send through the National Research Council an expression of support of this project, which it considers to be one of the scientific undertakings that need development in Canada.

The Section supported the suggestion that a Committee on Oceanography be formed with a membership selected from Sections III, IV, and V, this committee to look after the Society's interest in this field. The Section recommended to Council that such a Committee be formed, and if the recommendation were accepted, that H. B. Hachey, G. S. Field, and G. M. Shrum of Section III be the members appointed from that Section.

Report of Section IV

Section IV held two business sessions and three technical sessions including one symposium on the tectonics of the Prairie Basin. The sessions were attended by more than 125 Fellows and guests.

The Section noted with deep regret the deaths during the past year of two of its Fellows, Carl Faessler and J. B. Tyrrell.

Four new Fellows, D. M. Baird, R. M. Hardy, J. H. Hodgson, and J. A. Jacobs were elected and presented to the Society.

The following officers and representatives were elected by the Section for 1958–59:

President: L. S. Russell
Vice-president: F. F. Osborne
Secretary: S. C. Robinson
Additional Member of Council: H. C. Rickaby
Editorial Committee: L. S. Russell (*Chairman*) and other members chosen from among the Fellows of the Section in Ottawa
General Nominating Committee: M. Y. Williams, G. S. Hume
The Willet G. Miller Medal Committee: F. F. Osborne (*Chairman*), A. R. Byers, J. S. Stevenson, J. F. Caley, P. S. Warren
Advisory Committee for New Fellows: J. B. Mawdsley (*Chairman*), R. F. Legget, J. T. Wilson, R. T. D. Wickenden, B. T. Denis, J. C. Sproule, S. C. Robinson (*Secretary*)
Programme Committee: L. S. Russell (*Chairman*), R. F. Legget, F. H. Edmunds

The Report of Council was accepted.

The Section supported the holding of the Annual Meeting at Saskatoon during the week of May 31st, 1959, and elected F. H. Edmunds as its local representative.

A proposal made by Section V that Council be asked to re-establish a committee on Oceanography was supported by the Section on the motion of L. S. Russell. In the event that Council accedes to this proposal the following three Fellows were nominated to the committee by Section IV: J. F. Caley (*one year*), G. S. MacKenzie (*two years*), W. H. Mathews (*three years*).

A committee for the expansion and co-ordination of geological investigations in Canada was formed to implement suggestions made in his presidential address by H. C. Rickaby. It is anticipated that this committee will present a brief to the Conference of Ministers of Mines to be held in New Brunswick in September. Members of this committee are: H. C. Gunning (*Chairman*), D. R. Derry, H. J. Fraser, J. E. Gill, A. W. Joliffe, J. B. Mawdsley, J. C. Sproule.

Report of Section V

The Section held four meetings at which forty-two papers were read and some sixty to ninety Fellows and their guests attended the various sessions. These papers included the presidential address by Dr. W. R. Campbell, the Flavelle Medal address by Dr. A. G. Lochhead, and two invitation papers—one on the endocrine pancreas by Dr. R. E. Haist, and one on chromosome sex and phenotypical sex by Dr. Murray L. Barr. The Section also participated in the symposium of the Society on the potentialities of the Northwest.

The Section held two business meetings, approved the Report of Council, welcomed six new Fellows and stood for a moment of silence in respect to its deceased Fellows, Dr. J. B. Leathes and Dr. William Rowan. It noted with regret the transfer of Dr. F. L. Drayton, Dr. W. Leach, and Dr. C. C. Macklin to the retired list.

The Section discussed the need for additional basic research in oceanography. It was recognized that oceanographic studies are also of interest to other Sections and the following resolution was offered:

That the Royal Society be asked to establish an Oceanographic Committee composed of Fellows appointed by Sections III, IV and V, that this Committee elect its own Chairman, that the first Chairman be from Section III, and that this Committee be asked, if necessary, to prepare terms of reference for submission to Council at its February meeting.

The acceptance of this Report was moved by the Acting Secretary and seconded by Dr. W. R. Campbell.

The following officers and committee members were elected for the 1958–59 session:

President: N. H. GRACE
Vice-president: G. KROTKOV
Secretary: J. GIBBARD
Additional Member of Council: W. R. CAMPBELL
Editorial Committee: E. HORNE CRAIGIE (*Chairman*), A. FRAPPIER, R. D. GIBBS
General Nominating Committee: W. P. THOMPSON, T. W. M. CAMERON
Medal Committee, Flavelle Medal: to retire in 1959, L. P. DUGAL (*Convener*), A. W. NEEDLER, F. C. MACINTOSH; to retire in 1960, K. W. NEATBY, A. G. MCCALLA, C. P. LEBLOND
Advisory Committee (New Fellows): to retire in 1959, K. FISHER (*Chairman*), I. MCT. COWAN; to retire in 1960, M. J. DUNBAR, H. A. SENN; to retire in 1961, J. A. DAUPHINEE, G. A. LEDINGHAM
Programme Committee: D. S. RAWSON (*Chairman*), R. F. SHANER, L. B. JAQUES
Representatives on Editorial Board, Canadian Journal of Botany and Zoology: D. L. BAILEY, T. W. M. CAMERON

APPENDIX A

DISCOURS PRÉSIDENTIEL
PRESIDENTIAL ADDRESS

PROCEEDINGS OF THE ROYAL SOCIETY OF CANADA

VOLUME LII : SERIES III : JUNE, 1958

DISCOURS PRESIDENTIEL PRESIDENTIAL ADDRESS

The Evolution of Evolution

THOMAS W. M. CAMERON

IN 1908, the year which saw the founding of the University of Alberta, the Linnean Society of London celebrated the jubilee of the presentation of a very important joint communication. Although the communication was a joint one, the papers were separate and independently conceived. Both, however, said essentially the same thing—that all organisms had evolved from previous organisms by gradual steps under the selective effect of the environment in which they lived.

Early in 1858, Alfred Wallace had written to Charles Darwin from the East Indies asking him to submit to Sir Charles Lyell a memoir which he had enclosed. Darwin did so, although he realized that the theory described in Wallace's memoir bore an alarming resemblance to one he himself had been working on for some time. This memoir and extracts from earlier but unpublished papers by Darwin were presented to the Linnean Society under the joint title of: "The Tendency of Species to Form Varieties, and on the Perpetuation of Varieties and Species by Means of Natural Selection." Neither author was present.

Wallace was then only thirty-five. In early life he had been a schoolteacher, but when he was still in his mid-twenties he made his way to South America to collect natural history specimens—all of which were burned in a ship fire on the way home in 1852. He spent the next eight years in Malaya, and it was on a small island off the northeast tip of the Celebes, during an attack of malaria, that he had the inspiration which resulted in the memoir he sent to Darwin.

In his early twenties, Wallace had read Malthus on *Population*. Malthus had pointed out that far more human beings were born than were necessary to maintain the population at any given level, and so there was a continual tendency to increase in numbers. This increase was prevented by various factors, such as famine, disease, and war; if it were not, then in a very short time there would be insufficient room in the world to contain the enormous numbers of mankind.

Now, in 1855, Wallace had written an article for the *Annals and Magazine of Natural History* on a law regulating the introduction of new species. In this he noted that the geographical distribution of animals could *not* be explained by any of the theories so far suggested, and that recent geological

investigations showed that the earth is in the last stage of a series of long and uninterrupted changes, changes which had occurred over and over again. It followed that the present distribution of life is the result of these changes.

He noted that ten years earlier he had formulated a hypothesis which subsequent work had served to confirm and which he expressed thus: "Every species has come into existence, coincident both in space and time, with a pre-existing closely allied species." This law permitted of a true system of classification; it explained the geographical as well as the geological distribution of all forms of life. It not merely explained, it necessitated what exists.

During his fever, it suddenly came to him that the principles applied to human beings by Malthus could apply even more to animals, and that this self-acting process would necessarily improve the race in that the "fittest would survive." Then at once he saw the effect of this; the amount of individual variation which his experience as a collector had shown him to exist would adapt the species to a new environment when changes of the old environment took place, and so permit the unmodified to die out and the modified to survive.

If Wallace's genius was that of inspiration, Darwin's fitted Thomas Carlyle's definition of an "infinite capacity for taking pains." Wallace had read Malthus before he went to the East Indies, he had pondered over his law of distribution in 1845, but he had not crystallized his ideas until that day thirteen years later. Darwin, on the other hand, had had the same general idea in 1838, but for the next twenty years (it would have been even longer but for Wallace) he had collected data to support his thesis.

Darwin was born in 1809 and after a somewhat undistinguished childhood, was sent to Edinburgh to study medicine and later to Cambridge to read for the church. He found both boring. Instead, he became interested in natural history and in 1831 he sailed in H.M.S. *Beagle* on a five-year trip around the world, his only absence from England.

During the voyage he read Lyell's *Geology*, then a new and inspiring work. In the Argentine, he dug for fossils and saw the resemblances between them and existing animals, but it was in the Galapagos Islands that the first real inkling of "evolution by modification" came to him. There he noted that the local people could easily identify the island from which any individual tortoise came. These and other facts set him to thinking of how incompatible this was with the theory of the separate creation of every species, and in 1838 he outlined his views in a memoir to Hooker and Lyell.

In this he drew attention to the enormous multiplying power in all animals, in spite of which populations did not materially increase. These average numbers are kept constant by recurrent struggles against other species or external nature. Should the external conditions vary, the variety with characters better adapted to the new environment would have an advantage—even a minute one—which would result in a selective death rate and a selective survival rate. This selection would ultimately change

the characters of the species. This, he declared, was Natural Selection, or "the preservation of favoured races in the struggle for life."

The Wallace-Darwin communication was received at the meeting in 1858 in near silence and apparently without comment, but in the following year when Darwin's *The Origin of Species* was published, the volume was completely sold out on the first day. Evolution had finally arrived.

Thus, in 1858, the theory of evolution by natural selection came into being and completely revolutionized thought. Originally a doctrine applied to plant and animal life, it became a philosophy applied to everything—to all branches of science, to economics, to man himself. It introduced the concept of time into thinking and made thought dynamic instead of static.

At the jubilee meeting of the Linnean Society, the President noted that Wallace had always underestimated his own position as co-discoverer of evolution, actually going to the length of calling the joint theory "Darwinism," and so, although Wallace took an active part in the controversies which followed, his memoir of 1858 is almost forgotten today, and Wallace himself, when he *is* remembered, is as a zoogeographer and a writer on tropical wildlife.

The Linnean Society celebrated this jubilee by establishing a Darwin-Wallace Medal, of which Wallace was the first recipient (Darwin having died in the meanwhile). It might well have celebrated a centenary—the centenary of another almost forgotten man—one who was the real father of our modern ideas of evolution. This was Jean Baptiste de Monet, Chevalier de la Marck, one of the most misunderstood men in biological history, who is best remembered for a rather absurd theory of heredity accredited to him, called "Lamarckism," a theory which is a complete travesty of what he really thought and wrote.

Lamarck was sixty-five years old when he wrote his *Zoological Philosophy* in 1808, and discussed his theory of transformation, as he called evolution. Although he continued to work and to elaborate his doctrine in his later celebrated *Natural History of Invertebrates*, his ideas were ridiculed by Cuvier in France, and mistranslated and misinterpreted in England and elsewhere, where few biologists apparently had, or have, read the original publications.

Lamarck stated that animals as they had evolved had become more complex but in an irregular fashion, and that all animals were a joint product of this growing complexity and their environment, which tended continually to destroy the regularity of this growth. The environment did not directly effect any modifications, but changed circumstances produced changed needs, and changed needs produced changed actions. If the new needs became constant, new habits arose which also were constant, and organs increased with use, or decreased or even disappeared with disuse.

He said that in animals changes take place very slowly and it is often difficult to determine their cause—although undoubtedly the most important was the continually changing environment. These changes are so gradual

that we cannot observe them directly, and so animals everywhere preserve their habits for a long time, and give rise to the idea that species are permanent.

He therefore formulated two laws—the first, the law of use and disuse: use develops, disuse diminishes an organ. The second, the law of the inheritance of the effects of use and disuse, provided the circumstances causing these act over a long time.

He deduced from these that organs and members had developed as the result of need and use, not, as most naturalists had thought, that the presence of the organs had led to their appropriate employment. Permanent disuse of an organ as a consequence of acquired habits gradually causes it to become reduced and may ultimately cause it to disappear altogether.

Lamarck concluded, because every species has its characteristic habits and appearance that Nature had produced in succession all animal species, which had gradually become more complex, and that, dispersed throughout the world, our present faunas, under the influences of their environments, had acquired the shape and habits they now have. Changes under domestication, he felt, helped to show that this was true.

In his later book on invertebrates Lamarck noted, as did Wallace and Darwin subsequently, that so many animals were born that if they all survived, they would cover the entire earth. So only the strongest or fittest could survive, and those that could not adapt themselves to the environment would be eliminated. This is very close to the "struggle for existence" and "natural selection," although he did not ascribe evolution to the selection of chance variations but believed that the whole organism evolves as the result of an inner tension affected by the environment—gradually and over a long time. This last conclusion is the so-called "inheritance of acquired characters" which is usually referred to as "Lamarckism."

Lamarck suggested that the cause of development of traits by use (or disuse) lay in a "subtle fluid" which if repeated in a sufficiently long series of descendants, caused the condition to be inherited. This may be wrong; it is not "absurd" however, as so many subsequent workers have asserted.

Part of the *early* misunderstanding of what Lamarck meant was due to a poor translation of the French word *besoin* as "want" instead of the more usual "need." Both "need" and "want" *can* have nearly the same meaning, but "want" in English, in addition, also means "desire," and as "desire," Wallace, Darwin, and others interpreted it—and made Lamarck's ideas absurd. Thus, Lamarck held that the giraffe had gradually acquired its long neck because it *required* to reach its food. By mistranslation, this was taken to mean that the giraffe had acquired its long neck because it desired it. The first is a self-evident truth, the second an obvious absurdity.

Part of the *later* misunderstanding of his thesis has been failure to take notice of what he really said, and particularly to take into account the time factor which he postulated. It may well be true that Lamarck's ideas have not been substantiated by experimental evidence; it is also true that they

have not been disproved, while the long time factor required will make either proof or disproof extremely difficult.

Lamarck's great contemporary critic was Georges Cuvier—the founder of modern scientific palaeontology—who during his life enjoyed enormous prestige, becoming ultimately not only a peer, but also Minister of the Interior for France, and Chancellor of Paris University. Parts of the earth have obviously been alternately dry land and ocean, and Cuvier held that changes from one to the other have been catastrophic, destroying all animal life, and accordingly that none of the present agents of nature could have produced these changes. He concluded that fossil animals could not have been ancestral to those living on earth during the past five thousand years because a universal catastrophy had occurred burying most living creatures except for the few from whom present men and animals had arisen. Moreover, he held that such catastrophes had occurred previously a number of times.

These ideas were quite irreconcilable with those of Lamarck, and Cuvier used his prominent position to discredit Lamarck's philosophy with scorn and scurrilous abuse. As Darwin wrote later: "Great is the power of steady misrepresentation." Evolution could not possibly exist, and so Lamarck was laughed out of court and yet Cuvier, by his own work on palaeontology, initiated the research which, more than anything else, proved that evolution was more than an idea—it was a fact.

Cuvier was actually only giving expression to the ideas of creation popular at that time, ideas which were so definitely stereotyped that Bishop Ussher was able to state that the world had been created in the afternoon of the 22nd of October 4004 B.C. and few even thought of questioning this dictum, at least in public.

This belief was so well established that in 1758, Linneus was able to publish the tenth edition of his great *Systema Natura* in which he named all living creatures, saying: "We reckon as many species as issued in pairs from the hands of the creator." Linneus had a genius for classification and in his celebrated tenth edition he provided a system of pigeon-holes for the herbarium and the zoological museum which we still use. He invented the word "mammal" to include all warm-blooded animals with hair, and the word "primate" to include man, apes, and monkeys.

Not everyone even then, however, was able to accept the separate creation of all creatures, and one of the prominent dissenters was Louis LeClarc, Comte de Buffon, a contemporary of Linneus and one of the outstanding scientists of the day—lawyer, mathematician, physicist, agriculturist. He was a man with a magnificent belief in his own ability, who took the whole world as his subject and wrote a tremendous *Natural History* of twenty-four volumes on the earth, its mammals and birds, with seven supplements on minerals, physics, chemistry, and geology.

He had a profound contempt for Linneus, and perhaps in consequence of it, he formulated the doctrine that a continuous succession of forms runs

through the animal kingdom. He deduced that nature proceeds by unknown gradations from one species to another—gradations which are often imperceptible. He theorized on the probability of the mutability of species, believing that animals varied in response to changes in environment and habit, passing on the variations by an inherited memory. His ideas, however, were far from popular in high places and he was forced by the Sorbonne to recant his statements on the derivation of one species from another.

A rather later dissenter was Dr. Erasmus Darwin, the remarkable grandfather of Charles. He was undoubtedly inspired by Buffon, although he did not quite agree with him, and he undoubtedly was the main inspiration for his grandson. Erasmus Darwin expressed his views in *Zoonomia*—a profound medical treatise somewhat difficult to read.

He believed that animals evolved, adapting themselves to a changed environment under stimuli such as sex, hunger, and shelter. "All animals," he said, "undergo transformations which are in part produced by their own exertions in response to pleasures and pains, and many of these acquired forces or propensities are transmitted to their posterity." He realized that the struggle for existence checked rapid multiplication but he missed the further implication, which his grandson saw, of the survival of the fittest, although his phrase, "eat or be eaten" is very close to it.

In the century following the tenth edition of Linneus, geology had made considerable progress and the way was being prepared for an acceptable theory of evolution. The first geologist to state that the structure of the earth had undergone changes caused by agents at present existing was James Hutton of Edinburgh. He showed that land had been raised on a number of occasions and later reduced by air and water. This postulated a vast extent of time; the date of creation was now millions of years back and time was available for evolution.

But it was in 1830 that Charles Lyell brought geological order out of cosmic chaos, rejecting catastrophies for uniformity and gradual change. He recognized not only successions of rocks, but successions of plants and animals. However, although he established the principle of succession of geological strata, he continued to believe in the periodic extinction of flora and fauna. The absence of transitions seemed to him to be an insurmountable obstacle to organic evolution. Nevertheless, his work was a main factor in the origin of our modern ideas on the subject.

His book accompanied Darwin on the *Beagle* and had a deep effect on his thinking, and in 1858, Lyell (along with Hooker, the botanist) introduced Wallace and Darwin to the scientific world at that famous meeting of the Linnean Society. In the following year *The Origin of Species* was presented to the world at large. It brought the general idea of evolution to the public although its theme actually was confined to natural selection in changing varieties.

"Species have been modified during a long course of descent," wrote Darwin, "chiefly through the natural selection of numerous successive slight,

favourable variations; aided in an important manner by the inherited effects of the use and disuse of parts, and in an unimportant manner (that is in relation to adaptive structures whether past or present) by the direct action of external conditions and by variations which seem to us in our ignorance, to arise spontaneously."

The Darwin-Wallace explanation of evolution by natural selection of favourable characters is a statement of fact. It gives a plausible explanation of how natural selection works but it does *not* explain how these favourable characters arose. Both authors had in mind congenital, inheritable small variations as the material to be acted upon by natural selection. These variations had no power of developing in definite directions; direction came from selection.

The theory did not have a peaceful beginning and it aroused the fiercest controversy. It was misunderstood, misapplied, and misquoted. I think it was Confucius who said that speech was given man in order to disguise his thoughts, and there can be no doubt whatever that the underlying objection to the thesis was the fact that it demoted man from his position a little lower than the angels to something a little higher than the apes.

Some of the objections raised by the critics were obviously inspired by this idea: as, for example, Disraeli's question in Parliament, "Is man an ape or an angel? My Lords, I am on the side of the Angels." And Bishop Wilberforce's famous request to Huxley at Oxford to tell him, "Was it through his grandfather or his grandmother that he claimed his descent from a monkey?" ("Nature red in tooth and claw with ravin" was part of Tennyson's lament in *In Memoriam*, written some twenty-five years before 1858 although it was often torn from its context to describe natural selection.) Politician, prelate, and poet—all were disturbed.

Other critics were more cautious, and in the sonorous and complicated phraseology of the time disguised their anxiety with words. Some who would accept evolution, objected to "natural selection" as its sole cause, although Darwin himself had never claimed it to be. Others would have none of evolution by any means. One of these was the first President of the Royal Society of Canada, Sir William Dawson, then the Principal of McGill University, an eminent palaeobotanist and a rabid anti-evolutionist. He was willing and anxious to review *The Origin of Species* without even having read it.

It must be admitted that the phraseology of the biologists lent itself to misunderstanding, and that the argument was sometimes tedious and difficult to follow. The term "struggle for existence" was almost universally misunderstood and "survival of the fittest" increased the misunderstanding. The word "struggle" was thought of in its common physical sense, as also was the word "fittest." It was seized upon as a pretext for competitive struggle in business affairs, for supermen, for the thesis that to the victor go the spoils. Indeed, in 1902 Prince Kropotkin of Russia published his monograph on *Mutual Aid*, showing that mutual support as well as mutual

struggle was part of the mechanism by which the fittest were able to survive. There is nothing in natural selection which disputes this. The survival of the fittest means the fittest to survive, and survival was the only test.

Stripped of all complications, the theory simply stated that those individuals better adapted to their environment than others of the same species will have a tendency to have more descendants to whom they will pass on these characteristics.

The first law of evolution is really the first law of motion. Every organism continues in a state of rest or of uniform development in a straight line unless it is compelled by impressed forces to change that state. Actually, of course, the species is not altered—it is only the characters which are altered in the same species, so that the whole organism has a better survival value.

No one, before or since Darwin, has been able to define a species in a way satisfactory to everyone, but in bi-sexual animals one property of a species is that it cannot interbreed successfully with another species. Consequently, a new species can be formed only when the characters of some members of the old species are such that they prevent breeding with other members. Of course, if the new characters were absorbed into the whole species, then *in time* a morphologically different group would appear and would be regarded as new. And if some members of a species became isolated, whether in a new environment or in some other way, selection would ultimately permit a morphologically different race to appear—but it could only legitimately be called a new species when it was shown that its members could not breed with members of the parent race. Selection was, therefore, a function of both time and space.

Not all the critics were hostile: some were enthusiastic supporters, notably Thomas Huxley and Herbert Spencer; in fact, it is probable that, but for the support of these two remarkable men, the doctrine of evolution by natural selection would have languished for at least another fifty years.

Darwin himself was no advocate. He found writing difficult and speaking in public even more so. He was retiring, reticent, suffering from a chronic illness, almost certainly psychosomatic in origin, and he combined a pathological shyness with a passionate desire to have his work appreciated. To some extent he found this appreciation in Wallace, but his real and very vocal advocates were Huxley in the scientific field and Spencer in the philosophical one.

Huxley was a younger man than Darwin—he was only thirty-three when *The Origin of Species* was published. Like Darwin, he rather reluctantly studied medicine but, unlike Darwin, he finished the course and qualified. He was appointed Assistant Surgeon to H.M.S. *Rattlesnake* and went on a voyage to Australia to collect specimens in the Coral Sea. Unlike Darwin and Wallace, Huxley was a poor collector—he was too impatient—but he did study comparative anatomy on the voyage, and he did find a wife in Australia.

When *The Origin of Species* was published, Huxley was Professor of Natural History and Palaeontology at the London School of Mines, developing his ability as an artist, his tenacity of purpose, and his tremendous liking for controversy. In 1858 he was a sceptic so far as evolution was concerned. In 1859 he was the world's leading evolutionist, amazed that he had been so stupid not to have thought of it before.

Although he was never quite sure how natural selection could produce new species when artificial selection never did, he devoted the main part of his life to convincing the world that evolution was "descent with modification." His book on *Organic Nature* had as wide an audience as *The Origin of Species*. He tackled the problem of man's origin—to him the most important part of evolution—in *Man's Place in Nature*, which was read by a science-loving public as though it were a novel. In fact, at that time, to that public, science and Huxley were almost synonymous.

Herbert Spencer was undoubtedly one of the really brilliant men of a century ago, by training an engineer, with a gift for invention and explanation. He was never puzzled and had no difficulty whatever in explaining the universe. Six years before 1858 he wrote a famous essay on *Population*, producing a theory of social evolution which quite closely resembled Natural Selection. Those carried off prematurely, he felt, must on the average be those in whom self-preservation is least. It follows, therefore, that those left behind to continue the race are those in whom the power of self-preservation is the greatest, and these are the select of their generation. He was great on theory and Huxley once claimed that Spencer's idea of a tragedy was a deduction killed by a fact.

His philosophy combined the ideas of the conservation of energy (which Spencer called the persistence of force) with biological evolution into a synthetic system which included Malthus, laissez-faire, Uniformitism, and "Lamarckism." It was Helmholtz *cum* Darwin. Nothing is destroyed but everything changes shape. Sociology is part of science, and evolution is progress. The end point is ultimate perfection and complete happiness, as all the unfit would have been eliminated and a state of equilibrium reached.

His philosophy was developed in an age of competition, exploitation, and struggle, and he popularized the term "survival of the fittest" in human affairs. He found his greatest audience in North America, and although few people nowadays even know of his name, his philosophy is still a corner-stone of our modern social edifice, and the general impression of the average man that evolution is supposed to account for almost everything is largely derived from Herbert Spencer.

The kernel of the theory of evolution lies in heredity, and in 1858 the foundations of a new science were being laid in an obscure monastery garden in Czechoslovakia, where Gregory Mendel was planting his experimental plots of peas, and preparing the data for the explanation of how interspecific inheritance takes place. He worked with unit characters in his plants—

colour, appearance, size, and so on—and he showed that these were inherited as discrete characters in definite ratios. His work also showed that characters could be present but hidden and that there was always a pair of contrasting characters in his plants.

Mendel's work gave rise to the modern science of genetics which has to a considerable extent shown how interspecific characters are inherited, although we are still almost entirely ignorant concerning the methods of inheritance of fundamental functional characters.

An organism is not just a collection of unit characters, even of an infinity of such. It defies the mathematical law that the total is equal to the sum of its parts. It is more than this and the criterion of its success is its ability to function.

All organisms fall into groups with characteristic characters—an inherited and inheritable pattern common to all individuals in the species. Thus, all cattle are cattle and different from all sheep. No cow can have a sheep as its offspring, and nothing we have been able to do has changed a cow into anything but a cow. As Sir Winston Churchill said many years ago during an address in Edinburgh, beef is still beef and mutton is still mutton, in spite of all that artificial breeding has been able to accomplish. "I am convinced," wrote Darwin himself, "that Natural Selection has been the most important but not the exclusive means of modification." While increase in size or importance of various organs may be explainable on the selection hypothesis, it is much more difficult to explain the reduction in size or complete loss of organs—such as loss of sight in cave animals, of limbs in whales and snakes, of splint bones in horses and upper teeth in ruminants, and the theory of selection is even less convincing in attempting to explain the enormously complicated life cycles of internal parasites.

The selection hypothesis puts the burden of selection entirely on the environment and while in a way, this is true, it underestimates the ability of the organism's own selection. It is also true that we have no real conception of the organization of protoplasm, of its ability to grow and to reproduce, of life itself. Life is not merely passive clay in the hands of an external environment: it selects as well as is selected. Its phenomena are seldom painted in pure black or white: they are more often in some shade of grey. Nature is seldom simple and direct and frequently takes advantage of every possible means to secure her end.

While natural selection may not be the only factor involved in evolution, and Darwin's doubt would appear to be justified, there is little doubt in the minds of most biologists that evolution has actually taken place. The answer to the question, is evolution proved, however, requires qualification.

If one uses the word "prove" in its original meaning (as in the expression "the exception proves the rule" and as the carpenter still uses it) the answer is "yes." Evolution has been tested so widely and so often that it has a certainty that makes it a fact. If "prove" is used in its modern meaning, as we use it when we speak of scientific proof, the answer is "no." We cannot test

evolution experimentally in the laboratory—the time factor alone makes this impossible. Although we are not certain of the causes of evolution, the inference that evolution has taken place is compelling and no scientist now has any doubts.

Evolution is the history of living things, of the steps by which each creature has acquired the morphological, physiological, and psychological characters which distinguish it from all others. Before this story can be told fully, centuries must still pass—and even then it will be only partly complete. Its most important chapter concerns man himself.

It must be clearly understood that natural selection postulated no mythical and mysterious *deus ex machina*. "Natural" was merely opposed by Darwin to "artificial" (the selection by man of characters in domestic animals and plants in an artificial environment) and to "super-natural" (the doctrine of special creation). During the past century, however, it has become apparent that so far as man himself is concerned, the terms "artificial" and "natural" do not distinguish two separate entities. Man is part of nature and part of natural selection. He is a unique animal who is becoming increasingly able to create, and become part of, his own environment, and he shows a tendency to identify himself with Tennyson's "nature"—"red in tooth and claw"—as the main destructive force in the world.

The evolution of man became a matter of importance as the result of the acceptance of the general theory of evolution. His evolution obviously started at the time when the first vertebrates were formed, and has proceeded step by step ever since. It entered its final phase in the early years of the Ice Age from which we are still emerging. There the earliest species of true man appeared—Neanderthal man—whose remains were first described in 1858, almost simultaneously with the Darwin-Wallace communication.

Reptiles did not become scarce during the late Mesozoic—they changed. The highly specialized ones found the environment too much and died out. The less specialized grew feathers or hair and continued to develop and become specialized in their turn. At some stage in their evolution we called them birds or mammals—but the change was gradual and the division arbitrary. The specialized birds and mammals in turn disappeared and smaller unspecialized forms took on the race. We have no idea at what stage in the story hair, warm blood, internal foetal development, and so on appeared or when the mammal-reptile evolved from the reptile-mammal.

Man is the curiously modified descendant of an insignificant reptile distantly related to the dinosaurs which once roamed the plains of this land. He is related to all other vertebrates and probably to all other animals. He is not an "ape"—still less an "educated ape." There is no "missing link" and the gibes of politicians and prelates in the early days of Darwinism have long since lost their sting. The mammalian stem from which modern man evolved is obviously a primate one, but there is no real evidence that it is close to any of the other living primates, who appear to form a slowly disappearing group.

Man's more immediate beginnings probably commenced about the time that grassy prairies began their spread, when a small enterprising primate came down from the trees to seek its living on the ground. It learned to use its legs so as to convert a climbing into a running animal. Its brain became enlarged to reach its present size in the earliest species of man, before the ice of the full glacial period began to recede, although Neanderthal man seems to have developed his motor activities more than his thinking activities.

The doctrine of special creation had put man as the antithesis of nature; it personified nature as some mysterious physico-chemical entity, acting according to fixed laws and often acting against man's own interest. But evolution emphasized the unity of life and showed that all organic life was related. As a corollary, it followed that nature was an internal as well as an external force and that man's mind had become part of the environment, not only of himself but of all the world. With the arrival of man, nature reached a new, and possibly final, phase of evolution.

Civilization is the modern evolution of man, and civilization has to grow and change or decay and die. Growth and change do not always mean progress; in fact, the history of life on earth shows that more often they lead to extinction. Man is the first and only animal, however, that has had some control over his environment. Used wisely that control can lead to progress.

The primary cause of progress is not the struggle of man with man but of man with his environment. The fittest is the best adapted to existing conditions and the individuals who lose the struggle are not necessarily killed. The Machtpolitik philosophy justifying war stemmed from a misinterpretation of Darwin's ideas and many years ago Starr Jordan showed that war was a biological evil by carrying off the fit and increasing the unfit. All wars are civil wars, and civil wars are not sources of progress.

"Lamarckism" in its commonly accepted term is still a subconscious belief of most peoples. There is a quite general belief in the racial inheritance of acquired characters—especially mental characters—independent of environment. Yet genetics has shown quite conclusively that within the species *Homo sapiens* there must be such a great potentiality of characters and that no race of man can be judged inferior to any other provided the same environmental influences apply. Individuals everywhere, of course, vary. The human race shows the usual distribution curve seen in all organisms, but in a sufficiently large concentration of any peoples there is no doubt that this curve of potentialities would not differ materially. Only the development of these potentialities would differ.

So far as mental ability is concerned, knowledge can be acquired in a single generation, given proper facilities for education. It is not born in any one, but it is all contained in books, and each human being must start from the beginning, no matter what his origin. Man in this unique way has developed a synthetic manner of transmitting acquired characters; it is instinct committed to paper.

The mechanism of evolution we do not know, but of this we are sure, evolution is a fact and not only a fact of the past but of the present and the future. We cannot prophesy the future but this also we know, that evolution is not always progress and we cannot say whether man, insect, or microbe will eventually triumph. "The constitution of the heavenly bodies and the structure of the atom," said Sir Oliver Lodge, the great physicist, "are in a sense elementary compared with the problems which confront those who would ascertain and disentangle even the material aspect presented by living things."

Science, which is organized knowledge, and which in itself is neither good nor bad but only true or false, is still only scratching the surface of the universe and future generations have much to learn. Perhaps of most pressing urgency, however, is the need to understand that science is also a humanity and that the most important part of science is that dealing with life itself.

In 1858 Sir Richard Owen, addressing the British Association for the Advancement of Science spoke as follows: "We may confidently hope that this and other applications of pure science will tend to abolish war over the whole earth; so that men may come to look back upon the trial of battle between misunderstanding nations as a sign of a past state of comparative barbarism."

In 1958, we still continue to hope.

APPENDIX B

BIOGRAPHICAL SKETCHES OF DECEASED MEMBERS

Arthur Lewis Clark

1873–1956

OCCASIONALLY the United States makes a partial payment for the many scientists she has received from Canada. The late Arthur Lewis Clark is an outstanding example. A native of Worcester, Massachusetts, where he was born in 1873, he came to Canada in 1906 and remained until his death in 1956. As Professor of Physics at Queen's University, where from 1919 to 1943 he was also Dean of the Faculty of Applied Science, he made important contributions to Canadian science.

Although as an undergraduate he studied electrical engineering at Worcester Polytechnic Institute, after graduation he soon turned to physics. He spent three years in post-graduate study and research at Clark University, a graduate school of high standing from which he obtained his Ph.D. in 1905. Before that date he had spent several years teaching at Worcester Academy and Bates College, where he was a member of the Department of Physics. This combination of teaching and research, in each of which he had exceptional ability, characterized all his work throughout his active years.

The pattern of much of Clark's research work at Queen's was set by Professor A. G. Webster, a distinguished physicist on the staff of Clark University. In more than one of his early papers Clark acknowledges his indebtedness to Webster. One of these, published in 1906 in the *Proceedings of the American Academy of Arts and Sciences*, had the title "Surface Tension at the Interface between Certain Liquids and Vapors." This was the forerunner of an active programme of research carried out for many years at Queen's. His main work was in the field of thermodynamics and in the study of the molecular properties of liquids and vapours in the neighbourhood of the critical point. An important paper on this subject appeared in the *Transactions of the Royal Society of Canada*, vol. IX, in 1915, the year in which he was made a Fellow. Years later, when he was president of Section III, at a symposium on the Critical State in 1936, Clark gave a review of his recent work on *The Viscosity of Ethyl Ether*.

His early investigations attracted the attention of Kamerling Onnes of Holland and led to an invitation to visit the world-famous low-temperature laboratory at Leyden. Although Clark spent only three months in Holland, his visit had a marked influence on his subsequent work. He was greatly impressed with the freedom of Dutch professors to do research and with the importance of furthering our knowledge of the structure of matter by investigations at low temperature. At one time he had hopes, unfortunately never realized, that a cryogenic laboratory would be established at Queen's.

The extent to which Clark was an authority on thermodynamics is further revealed by an important series of papers done in collaboration with Leon Katz on the Joule and Joule-Thomson effects and the measurement of the

ratio of specific heats of various gases. The first of the Clark-Katz papers is an extended discussion of the Joule and the Joule-Thomson effects, the background for which had been given in Clark's paper on "The Definition of a Perfect Gas," published in the *Transactions of the Royal Society of Canada* for 1924. Later papers in the series describe measurements of the ratio of specific heats by a method which reflects the thoroughness, skill and precision which characterized all Clark's scientific work. The method, which consists in subjecting a gas to alternate compressions and rarefactions, involved precision measurements of low frequencies. Clark and Katz designed an oscillator by means of which frequencies from 10 to 100 per second could be maintained and measured to one part in 30,000. This piece of work deserves to rank as classic in the field of thermodynamics.

Important as Clark's researches were, his biggest contribution to the advancement of research at Queen's and in Canada is an indirect one. As early as 1917, at his instigation, the Trustees of Queen's appointed a committee for the promotion of scientific research in the university. Clark was made Chairman, a position he held until 1943. This committee was probably the most important single factor in the gradual development of research at Queen's. Clark was also responsible for two other important developments. The first was the establishment of the Chown Research Chair in physics (or chemistry), the second, the inauguration of the first course in engineering physics in Canada. Its success at Queen's and in other Canadian universities is ample evidence of the far-sightedness of A. L. Clark. But Clark did not confine his activities to Queen's University. From 1924 until 1939 he served with distinction as a member of the advisory board of the National Research Council. On the formation of the Research Council of Ontario in 1921 he was made one of the governing body, a position he held for many years.

Clark was a wise administrator and a humane man whose office door was always open to staff and students alike. His counsel was sought by both groups. It is pleasing to record that he lived to see a fitting tribute paid to his great services to Queen's and her students. Over the doorway of a fine stone building, which houses the club room of Queen's engineering students and the University Bookstore, the name Clark Hall is inscribed. His memory is thus enshrined in stone.

Clark's extra-curricular activities are further evidence of his humanity. When he retired in 1943 he was Chairman of the National Unemployment Insurance (Kingston Office), Vice-Chairman of the Kingston Welfare Committee and Chairman of its sub-committee for the Home for the Aged, and a member of the Board of Governors and Vice-Chairman of the Building Committee of the Kingston General Hospital.

For many years he was a keen golfer with a creditable handicap, but throughout his life his chief hobby was woodworking. In this he was no mere amateur, his work being well up to professional standards. On his retirement the members of the Faculty of Applied Science very fittingly presented him with a modern lathe for woodwork.

ARTHUR LEWIS CLARK

His family life was an exceptionally happy one. He and his wife grew up in the New England town of Worcester and when they came to Kingston they grafted into their Canadian home something of the flavour of New England hospitality. They had one son and two daughters and in course of time their life was rounded out by a number of grandchildren. Dean Clark is survived by his wife who continues to live in their old home.

J. K. ROBERTSON

Cyrille Fraser Delâge

1869–1957

UN après-midi de janvier 1925, l'Académie française recevait solennellement le sénateur Jonnart qui venait d'être élu au fauteuil de Paul Deschanel, ancien président de la République. A vrai dire, les titres littéraires du nouvel académicien étaient plutôt modestes, surtout si on les comparait avec ceux de son rival, Charles Maurras. Comme il fallait s'y attendre, l'élection et la réception ne se firent pas sans tapage. Témoin de l'une et de l'autre, et sans rien perdre de mon admiration pour le maître écrivain et le vigoureux penseur que fut Maurras, j'avais alors accepté de bonne grâce l'explication que donnait Mgr Baudrillart. L'Académie française ne s'était-elle pas toujours montrée soucieuse d'honorer aussi bien « ceux qui font l'histoire que ceux qui la racontent et la jugent » ?

Que Cyrille Delâge ne fût pas d'abord un littérateur, lui-même en convenait. Ayant la parole et la plume faciles, il lui suffisait de les tenir à la disposition des œuvres et des hommes qui étaient le plus près de son cœur, de les mettre inlassablement au service des causes qui réclamaient son aide. Deux volumes de *Discours et conférences* témoignent à la fois de la pureté de ses intentions, de la noblesse de ses sentiments, de la générosité de son âme. Ils témoignent aussi de son intelligence et de sa prédilection pour les choses de l'esprit.

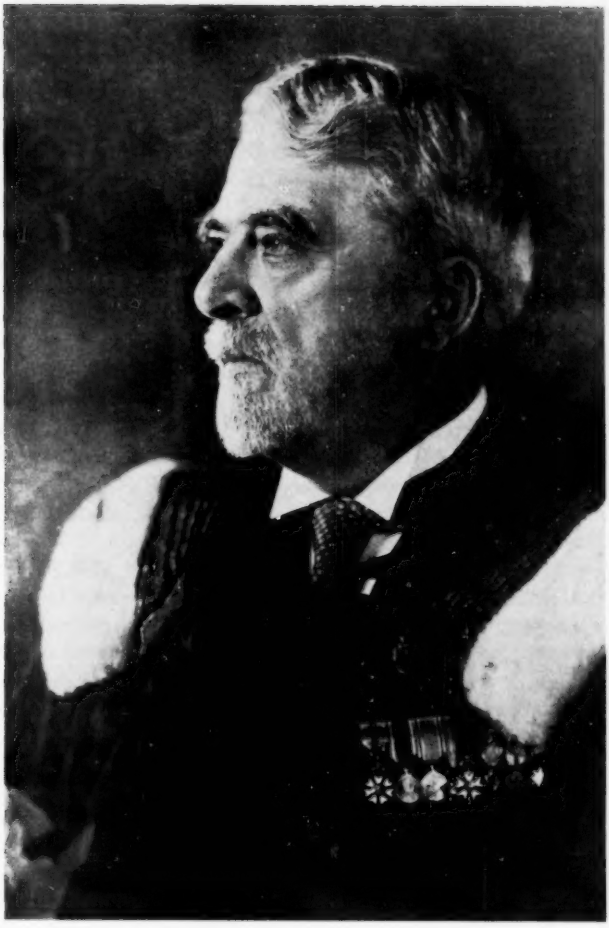
C'est en 1916 que Cyrille Delâge devint membre de la Société royale, l'année même où il se retirait de la politique active pour entreprendre, à quarante-sept ans, une fructueuse carrière dans l'administration provinciale. Jusque là, il s'était fait apprécier sans doute comme notaire habile et consciencieux dont maintes entreprises publiques ou privées recherchaient les avis et les bons offices. Serviable entre tous, il n'avait ménagé ni son temps ni ses peines chaque fois qu'on s'adressait à lui pour redresser une situation compromise, pour participer au lancement ou à l'expansion d'une œuvre patriotique, à l'étude ou à la solution d'un problème éducationnel. Pourtant, dès 1901, il siégeait, comme député de Québec, à l'Assemblée législative dont il fut le président de 1912 à 1916. En somme, Cyrille Delâge faisait l'histoire, et c'est ce que la section française de la Société royale n'avait pas hésité à reconnaître en offrant l'un de ses fauteuils symboliques au nouveau surintendant de l'Instruction publique.

Les cadres d'une notice nécrologique sont trop restreints pour me permettre de suivre à la trace Cyrille Delâge dans l'exercice d'une fonction dont il ne faudrait pas mesurer l'importance à l'ambiguité du terme qui la désigne. Un biographe averti s'en chargera peut-être qui, du même coup, ajoutera un long chapitre à l'histoire de l'éducation dans la Province de Québec; car l'exercice de cette fonction ne se termina qu'en 1939. Entre temps, distinctions et titres honorifiques, d'origine canadienne ou étrangère, avaient, avec une régularité impressionnante, souligné les mérites de Cyrille Delâge, l'estime et la confiance qu'il inspirait.

L'heure de la retraite était-elle enfin venue pour le septuagénaire dont l'action, toujours sagement ordonnée, s'était répandue dans les milieux les plus divers, lui-même paraissant aussi à son aise à la présidence de la Chambre des Notaires qu'au sein d'un conseil d'administration, devant les honorables membres du Comité catholique ou protestant de l'Instruction publique qu'en présence de littérateurs chevronnés ? C'était ne pas connaître Cyrille Delâge. Pas plus qu'en 1916, le changement d'état, en 1939, ne signifiait un terme. A la tête de la Commission des écoles catholiques de Québec aussi bien que dans les rangs du Conseil de la Vie française, de la Société historique et de l'Institut Canadien, l'aimable, courtois, dévoué Monsieur Delâge continua de proclamer, par sa présence seule ou par la sagesse de ses propos, les sentiments dont il était animé envers sa ville natale, sa province et son pays. Le croyant qu'il avait toujours été, doublé d'un parfait gentilhomme à l'humeur égale, poursuivait sa tâche quotidienne sur le même rythme, avec la même aisance que s'il eût eu trente ans. Il avait eu sa part d'épreuves, mais rien n'en filtrait dans sa démarche, son regard ou le ton de la voix. « Travaillons ! » devait-il se dire chaque matin, l'esprit alerte, l'œil vif, l'oreille fine; chaque matin qui, d'une année à l'autre, risquait davantage d'être le dernier.

Le 27 novembre, 1957, Monsieur Delâge vaqua aux affaires courantes dont il avait la responsabilité. Il ne rentra même chez lui qu'après dix heures du soir, ce jour-là, ayant pris une part active aux assises du Conseil de la Vie française. A minuit, Cyrille Delâge avait achevé le long et fructueux cycle de son existence terrestre, laissant aux membres de sa famille, à ses amis, à ses compatriotes l'exemple d'une vie probe et laborieuse, à ses confrères de la Société royale, dont il était l'un des doyens, le souvenir d'un personnage de grande distinction et du plus aimable des hommes. *Vir amabilis ad societatem.*

JEAN BRUCHÉSI



Cyrille Fraser Delâge

Alexander Joseph Denomy

1904–1957

THE death on July 19, 1957, of the Reverend Alexander J. Denomy, C.S.B., deprived the Pontifical Institute of Mediaeval Studies of a brilliant professor, the nation of a fine Canadian scholar, and the Royal Society of Canada of a devoted Fellow.

Born in Chatham, Ontario, on June 5, 1904, Father Denomy was the son of Alexander and Mary (*née* Brisson) Denomy. He received his early education in the Roman Catholic schools at Windsor and at Assumption College (now Assumption University) which was then the Roman Catholic college of the University of Western Ontario. In 1923 he was graduated with a Bachelor of Arts degree from the University of Western Ontario.

During that same year he became a member of the Congregation of St. Basil (C.S.B.) commonly known as the Basilian Fathers, spent one year in training at Toronto as a novice, and returned to Windsor where he taught for one year before entering upon his theological studies at St. Basil's Seminary, Toronto.

After his ordination to the priesthood in 1928, Father Denomy took up his studies in the School of Graduate Studies in the University of Toronto where he obtained his M.A. in Romance Languages and after a few years of teaching in St. Michael's College School (of which he was principal for a brief period) he resumed graduate work at Harvard University.

In 1934 he was awarded the Ph.D. degree from Harvard with high distinction and won a Sheldon Travelling Fellowship which enabled him to spend a further year of research at the Sorbonne and to consult the wealth of material in the subject of his interest in the famous Bollandist Library in Brussels.

From this period date his studies on the Anglo-French and Old French Lives of Saints Agnes and Barbara published in *Harvard University Studies and Notes in Philology and Literature*, 16 (1934), pages 51–68, a volume printed in Cambridge, at the Harvard University Press (1938) and *Mediaeval Studies*, I (1939), pages 148–78.

Returning from Europe in 1935 Father Denomy was appointed to the Faculty of the Pontifical Institute of Mediaeval Studies, Toronto, and from that time until his death held the chair of Comparative Literature in that institution. Also, as a professor in the department of Romance Languages in the School of Graduate Studies, Father Denomy gave courses in Provençal language and literature.

Thenceforward Father Denomy devoted himself to teaching, research, and publication.* For the thirteen years preceding his death he was the manag-

*A list of his published books and articles is published in *Mediaeval Studies*, 19 (1957), the last item being a study of "An Old French Poetic Version of the Life and Miracles of Saint Magloire (Part One)" upon which Father Denomy was at work when he was summoned from this world.

ing editor of *Mediaeval Studies*—the annual publication of the Pontifical Institute of Mediaeval Studies—which, largely through his efforts has become an important periodical publication in mediaeval scholarship.

Father Denomy had long enjoyed the respect and confidence of his fellow scholars in the field of Romance Languages and received appropriate recognition when he was appointed to the advisory board of *Speculum*, the official publication of the Mediaeval Academy of America, in 1947 and was awarded a Guggenheim Fellowship in that same year. In 1948 he was elected a Fellow of the Royal Society of Canada and in 1951 became a Corresponding Fellow of the Mediaeval Academy of America.

Father Denomy departed this life in the fifty-fourth year of his age at a time when his learning had reached that tranquil maturity which lends gracious charm to scholarship and his future promised to crown with still greater achievements an already brilliant career. R.I.P.

GERALD B. PHELAN

Alexander Joseph Denomy

Carl Faessler

1895–1957

LA mort subite de Carl Faessler, survenue le 1er octobre 1957, enlevait à l'Université Laval l'un de ses professeurs les plus distingués et, à la Faculté des Sciences en particulier, l'un de ses membres les plus actifs et les plus estimés.

Carl Faessler est né le 24 septembre 1895, à Steinen, canton de Schwyz, en Suisse. Il a fait ses études primaires et secondaires dans les écoles de Feusiberg et de Steineberg, puis au collège Maria Hiff, à Schwyz, où il obtint, en 1916, son diplôme de bachelier ès arts. A l'Université de Fribourg où il s'inscrivit en 1917, il étudia pendant six ans la chimie plus particulièrement, mais aussi la botanique et la minéralogie.

Son diplôme de docteur ès sciences lui a été conféré à la suite de la soutenance d'une thèse en chimie organique. Il obtint ce diplôme le 2 juillet, 1923. Deux mois auparavant, il avait déjà reçu de l'Université Laval l'offre de venir au Canada pour enseigner à l'Ecole Supérieure de Chimie, récemment fondée à Québec le 29 octobre, 1920. Cependant, avant de quitter la Suisse, il épousa Marie Annen, le 9 juillet, 1923.

A l'Université Laval, il donna d'abord quelques cours en chimie organique, mais sa principale occupation, dans la suite, fut d'assurer l'enseignement de la minéralogie et de la géologie aux étudiants de troisième et de quatrième années en chimie. On lui confia aussi, pendant un certain temps du moins, les cours de chimie industrielle.

Au fur et à mesure que se développait l'Ecole Supérieure de Chimie, et surtout lorsque celle-ci devint la Faculté des Sciences de l'Université Laval, le professeur Faessler n'enseigna que la minéralogie. Cette science, il l'aimait particulièrement; les travaux qu'il a laissés le témoignent clairement.

Cependant, le Dr Faessler a toujours continué à s'intéresser très vivement à la géologie. De 1927 à 1943, il passait les saisons d'été sur le terrain, y faisant des travaux pour le compte du Ministère provincial des Mines. Il étudia plus spécialement la Côte-Nord du St-Laurent, depuis Tadoussac jusqu'au delà de Moïsie, à l'est de Sept-Iles. Il fit également d'autres explorations dans les comtés d'Abitibi, de Frontenac, de Papineau, de St-Maurice, etc. On trouve les résultats de ses travaux dans les *Rapports* du Ministère des Mines, dans *Le Naturaliste Canadien*, dans la *Revue de l'Université Laval*, ou encore dans *Economic Geology* et dans *University of Toronto Studies*.

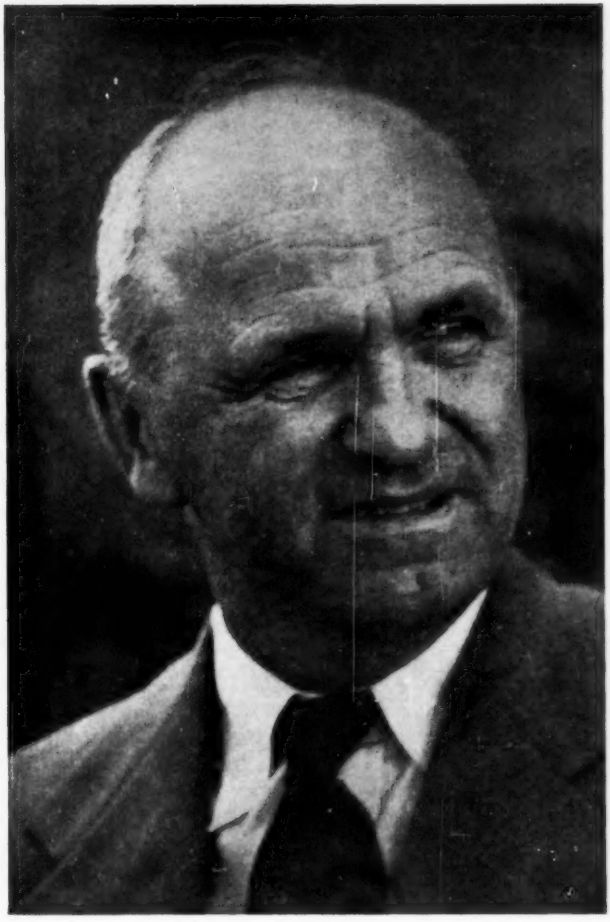
Le Dr Faessler était membre de plusieurs sociétés scientifiques et, dans certaines d'entre elles, il prenait une part très active. Ainsi par exemple, les procès-verbaux de la Société Linnéenne de Québec comportent au moins quatorze conférences faites devant les membres de cette société. Aux réunions annuelles de l'Association Canadienne-Française pour l'avancement des Sciences, le Dr Faessler présentait chaque année un ou plusieurs travaux. La liste complète comprend au moins trente titres différents.

Parmi les autres groupements dont il était membre, on pourrait citer la Société de Philosophie de Québec, the Canadian Institute of Mining and Metallurgy, the Walker Mineralogical Club (University of Toronto), la Société Géologique de Suisse, la Société suisse de Minéralogie et de Pétrographie, the National Geographical Society, the Mineralogical Society of America, the Geological Society of America, etc. Mais il n'y a aucun doute que la Société Royale du Canada a été celle à laquelle il tenait le plus. Il en fut élu membre en 1952.

Le travail le plus impressionnant laissé par le Dr Faessler est, sans contredit, la série des *Cross-Index* concernant les publications du Ministère des Mines d'Ottawa, du Ministère des Mines d'Ontario et de celui de la province de Québec. Cette série de tables comprend quatre volumes. On y trouve, énumérées, toutes les cartes et illustrations publiées par les organisations mentionnées ci-dessus, celles d'un auteur donné, celles se rapportant à un lieu ou à un sujet donné, ainsi que leurs numéros officiels, leurs années de publication, et les mémoires ou les bulletins qui les accompagnent ou les contiennent. L'ensemble de ce travail a été fort apprécié dans tous les milieux géologiques et par les bibliothécaires.

Le Dr Faessler laisse pour déplorer sa perte, son épouse et quatre enfants: Walter, Charlotte, Carl, et Alexandre.

J.-W. LAVERDIÈRE



Carl Faessler

John Beresford Leathes

1864–1956

PROFESSOR J. B. LEATHES, the first Professor of Pathological Chemistry at the University of Toronto, died at Montreux, Switzerland, on September 14th, 1956. He was ninety-one years of age.

John Beresford Leathes was born in London, England, on November 5th, 1864, the son of Rev. Stanley Leathes, D.D. He was educated at Winchester, New College, Oxford, and Guy's Hospital, London, graduating B.M., B.Ch. Oxon. in 1893. The following year he took the F.R.C.S. but never engaged in the practice of surgery, probably because of poor eyesight. He chose physiological chemistry as his subject of study for a career in research and teaching, and worked for two years under Drechsel in Berne and two years under Schmiedeberg in Strasbourg. Upon his return to England he was appointed lecturer in physiology at St. Thomas's Hospital, London, and a member of the staff of the Lister Institute. Here he continued his researches on the metabolism of fats, the results of which were to make him an outstanding authority on the subject. In a lecture delivered in January, 1909, before the Harvey Society of New York, entitled "Functions of the Liver in Relation to the Metabolism of Fats," Leathes reported the results of the researches of himself and his co-workers which revealed that the chemical characteristics of fat deposited in adipose tissue were different from those of fat found in liver and other organs of the body. Their work also showed that the liver occupies an extremely important position in the metabolism of fats.

In the same year a new chair of pathological chemistry was established in the Medical Faculty at the University of Toronto. Leathes was approached and accepted the chair. At that time instruction in biochemistry for medical students was limited and confined to the pre-clinical years of training. There was little application of biochemical knowledge in the clinical years of training of medical students and very limited use in the hospital of chemical methods in the study and diagnosis of disease. As Leathes was deeply interested in stimulating a wider application of chemical knowledge and chemical methods in the investigation and study of disease in man, he welcomed the opportunity provided by this new chair in pathological chemistry. For students in their clinical years of training he gave two courses of lectures: one on general disorders of the chemical processes of the body and one on the metabolic aspects of diseases of special organs such as the pancreas, kidney, and thyroid. Clinical chemical laboratories were established in the two teaching general hospitals, with a member of his staff in charge, for the use of students in the chemical examination of material obtained from their cases on the wards. He provided laboratories in the Department of Pathological Chemistry for the use of interns in the hospital and for graduate students wishing to obtain further training in pathological

chemistry and a discipline in research as a preparation for a career in teaching and research in clinical medicine.

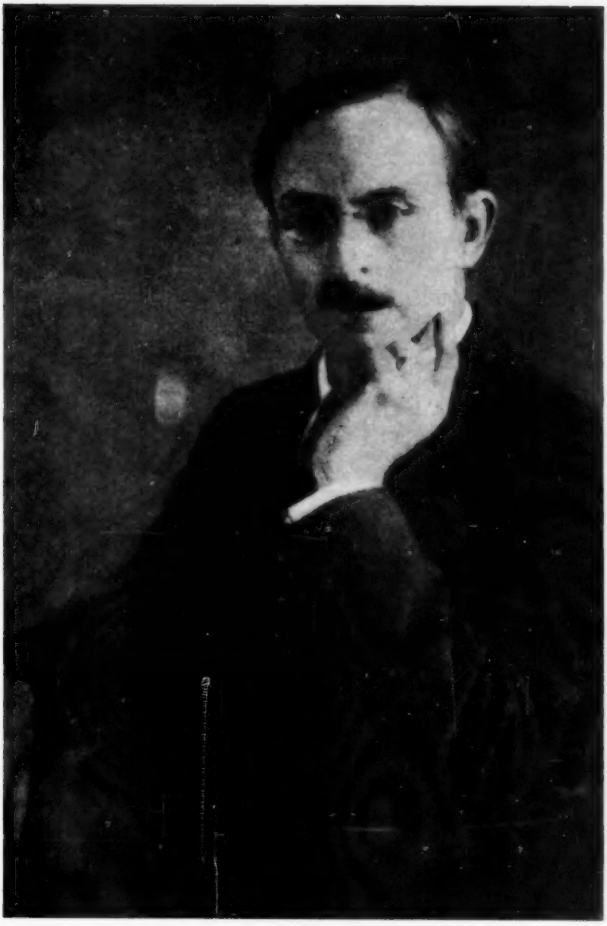
In 1910 he published a monograph on fats, giving a general and detailed account of existing knowledge on the subject. A second enlarged edition of the monograph prepared in collaboration with a former graduate student, the late H. S. Raper, appeared in 1925. His contribution to our knowledge of the metabolism of fats was recognized by his election to the Royal Society of London and the Royal Society of Canada in 1911.

After the outbreak of the war in 1914 Leathes was invited by the Vice-Chancellor of the University of Sheffield, H. A. L. Fisher, who had known him at Oxford, to take the chair of physiology at Sheffield and he accepted the offer. He occupied the chair in physiology, which included physiological chemistry, until his retirement in 1933 and during this period served for several years as Dean of the Medical School. Leathes pursued his efforts for the continuance of the teaching of the pre-clinical sciences in the clinical years of undergraduate training and for the promotion of a wider application in the hospital of the thought and methods of physiology and biochemistry in the study and diagnosis of disease in man. Both at Toronto and at Sheffield he was eminently successful in these undertakings.

In 1921, under a special by-law, he was elected a Fellow of the Royal College of Physicians of London. He received the honorary degree of D.Sc. from the University of Sheffield in 1933 and from the University of Manchester in 1936. After retirement from Sheffield he worked in Oxford until the outbreak of World War II and was elected an honorary Fellow of New College.

Leathes will be remembered for his fundamental contributions to our knowledge of the metabolism of fats. He will be remembered for his pioneering work to obtain a wider application of chemical thought and chemical methods in the elucidation of obscure problems of disease in man and for the fundamental part he played in bringing modern scientific methods into the teaching and practice of clinical medicine.

DUNCAN GRAHAM



JOHN BERESFORD LEATHES

Chester Martin

1882–1958

THE death on April 2, 1958, of Professor Emeritus Chester Martin ended the career of one of the most distinguished members of the second generation of professional Canadian historians. The founders of historical studies in Canada—G. M. Wrong, Adam Shortt, Arthur Doughty, and C. W. Colby—established history as an important subject in the curricula of Canadian universities and began popularizing Canadian history through the publication of large-scale co-operative historical works. The task which confronted their successors was a different but equally important one. The new generation, which did most of its work after the conclusion of World War I, sought to carry the study of Canadian history forward into more modern periods and with more modern methods. These historians were more interested than their predecessors had been in constitutional and economic history and in original research and manuscript materials. The group included Duncan MacArthur, R. G. Trotter, and H. A. Innis; its senior member was Chester Martin.

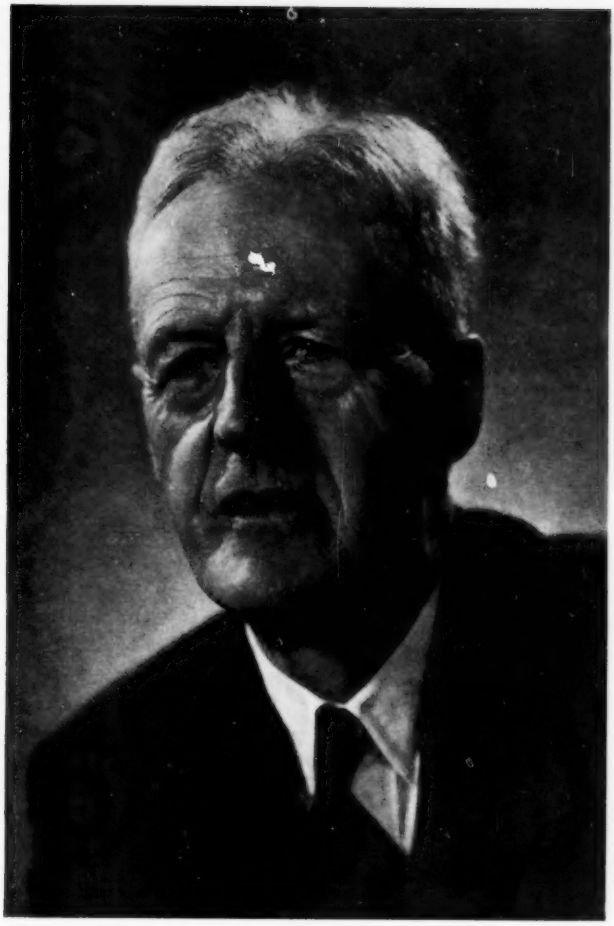
Chester Martin was born in Tremont, King's County, Nova Scotia, on June 22, 1882. The brilliance which he early showed as a student continued throughout his entire academic career. At the University of New Brunswick, he was awarded the Wilmot Scholarship, and won the Montgomery-Campbell prize in senior Classics together with gold medals for Latin and English essays. In 1902, at the age of twenty, he graduated; and he competed successfully for the first Rhodes Scholarship awarded in North America. At Oxford, he entered Balliol College, and decided to read history; and A. L. Smith, who did much to create Balliol's reputation in the History Schools and subsequently became Master of the College, was his tutor and became an important formative influence in his career. At Balliol he won the Gladstone Memorial Prize for an historical essay, and was awarded a Brassey studentship and a Beit Scholarship. He took his M.A. degree from Oxford in 1907.

In Canada his career began in the Public Archives at Ottawa, where Arthur, later Sir Arthur, Doughty was already establishing the principal centre of Canadian historical scholarship. In the Archives, Martin acquired that respect for the primary source, and that knowledge of the documentary materials for Canadian history which thereafter became such an important part of his equipment as an historian. In 1909, when he was only twenty-seven, he was invited to the chair of Modern History at the University of Manitoba; and there the next twenty years of his career were spent. An easterner, he had come to the west while still a young man; he was a witness of two of the most exciting decades of the west's development; and, along with J. W. Dafoe, he became a member of a small group of Winnipeg intellectuals which had a considerable influence on the thought of the west, and of the nation as a whole, at the time.

The west made a deep impression upon Martin's mind. The west—its history, rights, and prospects—was the principal theme of his studies during more than half of his time at the University of Manitoba. He was old enough to have a share in the making of that first great co-operative venture of Canadian historical scholarship, *Canada and its Provinces*, though, at thirty, he must have been among the younger of its contributors; and the nineteenth volume in the series, which was devoted to the west, includes, as one of the principal parts of its contents, the long articles by Martin on the early history of Manitoba. Manitoba was also the main theme of his first published book, *Lord Selkirk's Work in Canada*, which came out in 1916; and Manitoba's territorial claims and Manitoba's autonomous control of its own development were contemporary problems of importance to which he began to give a good deal of attention soon after World War I. The return, with compensation, of the natural resources of the prairies, which the Dominion had acquired at Confederation for national purposes, was now demanded by the western provincial governments; and Martin became a powerful exponent of the historical justice of the provinces' claims. He made a report on the subject to the provincial government of Manitoba; and published it in 1920, under the title *The Natural Resources Question*.

The west continued to take up a good deal of his time and effort during the last years of his residence in Winnipeg. *The Kelsey Papers*, which he edited in collaboration with A. G. Doughty, came out in 1929; and in 1928–9, he acted as adviser to the provincial government of Manitoba in its representations before the Natural Resources Commission. Already, however, he was pushing the main interests of his research backward in time, and eastward in space, towards the beginnings of British North American history. Here also he had taken up a theme which was of immense significance to his contemporary Canadians, not only in the west, but also throughout the nation as a whole. The full achievement of Dominion status was announced in principle in the Balfour Declaration at the Imperial Conference of 1926 and formally proclaimed in the Statute of Westminster in 1931; and Martin's *Empire and Commonwealth*, which appeared in 1929, midway between these two dates, was a mature and subtle historical analysis of the long process which the Declaration and the Statute were just ending. The essays of which the book was composed followed, as their author modestly claimed, a well-marked theme; and the theme was the gradual advance from governance to self-government in the British Empire.

In 1928 Martin was elected president of Section II of the Royal Society; in the following year he assumed the presidency of the Canadian Historical Association; and in 1929 came his appointment to the headship of the Department of History at the University of Toronto. He succeeded to the chair which Professor G. M. Wrong had occupied for over thirty years and which had been established as far back as 1853 with the appointment of Daniel, later Sir Daniel, Wilson to the professorship of history and English literature. Wilson and Wrong, the two founders of history at Toronto, had



CHESTER MARTIN

done their work. The honour courses had been organized, the basic undergraduate curriculum in history laid down, the tutorial system, with its weekly essays and discussions, firmly established, and a staff of younger men, able as individuals and effective in co-operation, had been acquired. The Department had already secured an enviably distinguished place in the University; and it was Martin's task to maintain and improve this position, in the light of the very altered circumstances of the second quarter of the twentieth century. During his headship, the teaching programme of the Department was enlarged and strengthened, particularly in the sphere of mediaeval and Renaissance history; but his greatest contribution was probably made in the organization and immense extension of graduate work. His own devotion to scholarship both attracted and inspired graduate students; and he achieved his ambition of making Toronto the principal centre of senior historical research in Canada.

During this first decade of his tenure of the chair at Toronto, he continued to publish at regular intervals. The articles which he contributed to the *Cambridge History of the British Empire*, vol. VI: *Canada*, summed up his studies in the history of the Maritime provinces; and "British Policy in Canadian Confederation," a paper published in the *Canadian Historical Review* in 1932, was an important and provocative contribution to the literature on the federal movement in British North America. At the same time, while he continued and developed his studies in eastern political history, he did not neglect the west. In *Simpson's Athabaska Journal*, published in 1938, which he edited for the Hudson's Bay Record Society, he returned to a subject which had first engaged his interest over twenty years before when he began his work on Lord Selkirk; and *"Dominion Lands" Policy*, the large-scale study of western land policy which he contributed in 1938 to the Canadian Frontiers of Settlement series, had its origin in his earlier work on the western natural resources question.

He saw the Department of History through the difficult days of World War II, and through the still more difficult days of the vast post-war expansion. The staff which had numbered about half a dozen when he first occupied the chair at Toronto had grown to nearly three times that size; and the Department's graduate work, which he had done so much to encourage and promote, had become a very important part of the activities of the newly re-organized School of Graduate Studies. He presided over the Department's removal from its old home in Baldwin House to its new and handsome quarters in Flavelle House; and when he retired in 1952 he had rounded out the first century of history at Toronto—a century which had begun in 1853 with the appointment of Professor Daniel Wilson. At the same time, he was well on the way towards the completion of a grand synthesis of his own historical studies; and in 1955 this was published as the *Foundations of Canadian Nationhood*.

Martin's contribution to history in Canada resembled his predecessor's in some important respects, yet was distinctively his own. Like Wrong, he was

interested mainly in Canadian themes; and although his books never reached so wide a popular audience as those of the author of *The Canadians*, he had all Wrong's sense of fine literary craftsmanship in the writing of history. His style, with its biblical echoes and occasional classical allusions, was a cultivated literary style, very far removed from the commonplace mixture of mediocre writing and pretentious jargon which is characteristic of so much modern scholarship, particularly in North America. His prose had strength and shape and quality; and through its author's deft selective skill in the art of quotation, it enabled the reader to find his way back to the spirit of a bygone age by the echoes of its own speech and writing. Martin rarely quoted at any great length from his authorities; but his dexterous use of the expressions, sentiments and turns of phrase of his characters and their age gave to his writings a subtle, authentic flavour of the period with which they dealt.

Throughout his writings, Martin stood for the modern conception of historical scholarship, with its dispassionate quest for truth and its reliance on original research in manuscript and other contemporary materials. His career had begun in the Canadian Archives; and he remained true to the idea of the meticulous and comprehensive inquiry into the records of the past which the great archival collections have done so much to encourage and facilitate. He had a strong belief in the value of history in the formation of individual character and in the growth of civic virtue; and his high idea of the gravity of the historian's vocation deeply influenced both his teaching and writing. He never wrote an historical period down or condescended to its principal figures: his distaste for the cheap effects of the "debunker" was instinctive and lively. He stressed instead the importance of his subject matter, the seriousness of the issues which it involved, and the human dignity of the historical characters concerned with them.

D. G. CREIGHTON

William Rowan

1891–1957

WILLIAM ROWAN was born in Basle, Switzerland, of Irish-Danish stock on July 29, 1891, and died at Edmonton, Alberta, on June 30, 1957. The intervening period, falling just short of sixty-six years, seems all too little for a man of such limitless energy, manifold enthusiasms, widespread influence, and potentialities still unfulfilled. He died young.

In 1908 Dr. Rowan emigrated to Alberta and worked as a cowboy on a ranch near Dorothy; and to the end of his life he would speak with boyish delight of his boots-and-saddle days. Before long, however, he returned to England and formal education. This was interrupted when in August, 1914, he enlisted in the London Scottish Regiment in which he served until his honourable discharge in 1916. In 1917 he graduated from University College, London, with the B.Sc. degree. Both his adventure into what must have seemed to him the wilds of the Canadian West and his immediate enlistment at the outbreak of World War I are characteristic of the man.

Equally characteristic was his self-instruction in the fine arts. He was an accomplished pianist, and he developed genuine skills in drawing and sculpture with no more formal training than two weeks at the Slade School of Art.

For so gifted a young man there were "many roads to take." He chose science; but in after years sometimes looked back a little wistfully with the thought that he might have been a concert pianist; and he could certainly have made his way in the world of drawing, painting, and sculpture. This decision was made in 1919 when Dr. Rowan married Miss Rita Bush and returned to Canada to lecture in Zoology at the University of Manitoba. In 1920 he founded the Department of Zoology at the University of Alberta; and remained Head of this Department until his retirement in 1956. His death was a shock to a large circle of friends in several countries. He is survived by his wife, and by two sons (William Oliver and Frederic Julian), and three daughters (Mrs. J. G. McPhee, Mrs. Reginald Bentley, and Mrs. Frank Stretton).

Probably few university lecturers in his time had the lasting influence upon undergraduates that Dr. Rowan had. He was a born showman; his gift for illustration, both verbal and graphic, was superb; and generation after generation of students paid the warmest tributes to his ability to challenge the mind and stimulate study.

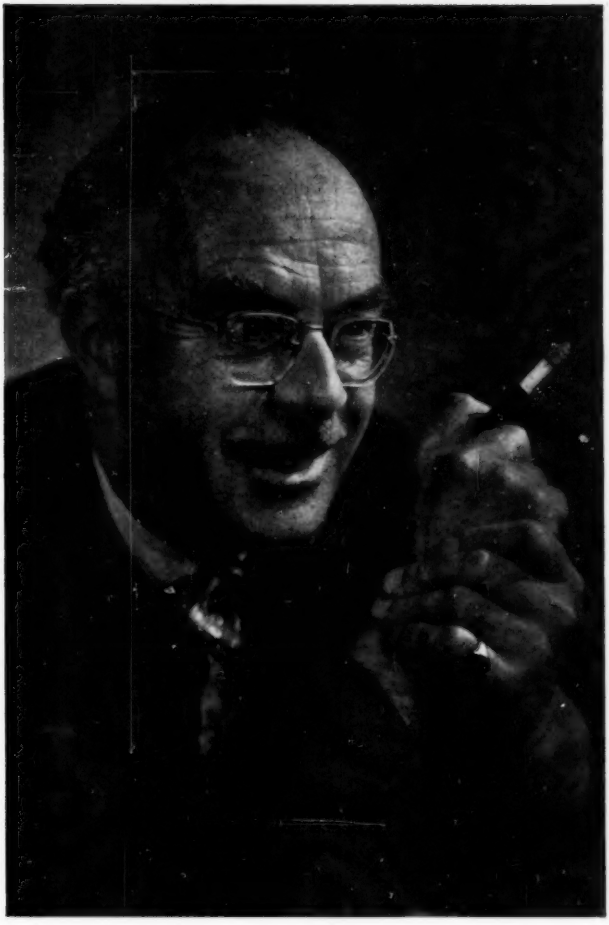
In the small University of Alberta of the early twenties, a bundle of unsatisfied needs, there was little money to encourage individual research; and Dr. Rowan smarted for years with resentment at the answer of one harassed administrator that "birds are not science." For, expert as a zoologist in general, it was ornithology that especially attracted him. Quite early he found himself puzzled by the problem, Why birds migrate. In reply he

postulated a gonadal hormone which impells migration and whose development is affected by increasing and decreasing day-length. In his own garden he caged canaries and juncoes and, working at times under great difficulty, was able to prove experimentally that the seasonal shortening and lengthening of the day cause a cyclic development and recession of the gonads of birds. Next, by controlled artificial lighting he tried to make juncoes sedentary during the normal migratory season and to cause birds to fly north when they should fly south. The results of these experiments were presented as a thesis to the University of London in 1929 when Dr. Rowan became a D.Sc. in a field that was "not science." In the same year he was elected Fellow of the Zoological Society of London.

Dr. Rowan did not feel that his experiments with small birds were conclusive. He needed birds which could be more easily recaptured. He therefore repeated his experiments with crows, and although long, patient work was nullified when vandals broke into the cages, he did succeed in reversing the normal direction of migration of crows. In this work Dr. Rowan's flair for getting other people interested in scientific problems came to the fore: he had farmers and others all over Alberta, and indeed elsewhere, co-operating in reporting upon the experimental birds he set free. In 1931 he published *The Riddle of Migration* and gained international standing as a scientist. He had definitely proved that photoperiodism is a controlling factor in the migration of birds. His amazing ability to interest the public in science also meant that he was able to collect for the University of Alberta an extremely large and varied collection of zoological specimens. Everyone in the province, and far beyond, who chanced upon an unusual specimen knew at once where to send it!

After 1931 Dr. Rowan devoted his studies largely to the cyclic fluctuation in numbers of various North American birds and mammals, and to problems of conservation of wild life. He felt able to establish a definite ten-year cycle from peak to peak in the numbers of various species. In 1934 he was elected Fellow of the Royal Society of Canada, and in 1946 he was awarded the Flavelle Medal in recognition of his contribution to Canadian science. He published during his life a very large number of scientific articles, received many honours, and left at his death the manuscripts of several unfinished books of which one, devoted to conservation of wild life, has a title completely revealing as to its author, *Beloved Wilderness*. To the very end Dr. Rowan was still working energetically on the subject of cyclic fluctuation —and, at the same time, lending his infectious enthusiasm to the movement for setting up a magnificent zoological garden in Edmonton.

To his skill as a scientific solver of problems Dr. Rowan added the keen perceptions and sensitiveness of an artist. In sculpture he was deft and adept, but his work with a pencil was beyond praise. His drawings of animals and birds were a free gift to any worthy enterprise: they lent distinction to many issues of *The New Trail* (the alumni magazine of the University of Alberta), and some of them were used as stamps on hunting licences in order to raise



William Rowan

money for wild life conservation. His whooping crane was bought by the Dominion of Canada for a postage stamp in 1955. Some of his originals are in the Fogg Art Museum of Harvard and in the Reading (England) and other Art Galleries. He exhibited also at the Royal Canadian Academy of Art. To photography Dr. Rowan brought the same artistic gifts and exhibited his work at the Royal Photographic Society (London) and other international exhibitions.

Many-sided, many-gifted, Dr. Rowan was a man of the keenest, boyish enthusiasms. No one who had spent five minutes in his company would ever forget him. He made the science that was not a science meaningful to a whole province; and as artist, lecturer, and man he served his time and his generation well.

F. M. SALTER

Joseph Burr Tyrrell

1858–1957

ON Monday, August 26th, 1957, there passed away in his ninety-ninth year at his home at 14 Walmer Road, Toronto, Canada's senior geologist, Dr. Joseph Burr Tyrrell. A geographer who charted routes across vast hitherto unknown spaces of western Canada, an engineer keenly interested in Canada's mineral resources and their development, an historian who contributed greatly to our knowledge of the early exploration of western Canada, but above all a geologist, Tyrrell in his long life made a continued succession of contributions to his country and to science.

Born at Weston, Ontario, on November 1st, 1858, Tyrrell graduated from the University of Toronto in 1880 and in the following year joined the staff of the Geological Survey of Canada under the latter's second director, Alfred R. C. Selwyn. It was a time of expansion of geological mapping and investigation. Confederation had added greatly to Canada's territory both to the maritime east and to the little explored west and north and the task of securing information about all this broad expanse was a challenging one. Selwyn was, however, fortunate in his choice of helpers. He gathered around him a group of workers whose names stand out brightly in the history of Canadian geology. The death of Tyrrell removed the last member of this famous coterie.

Tyrrell's initiation into geological field work was under George Mercer Dawson in the Rocky Mountain region which he crossed four times through different passes. His next project, an independent one this time which occupied three years, was the mapping of the region north of Calgary and east of the Rockies. It was while he was thus engaged that he made the important palaeontological discovery of dinosaur remains in the Red Deer valley. From 1887 to 1890 he was occupied in mapping an area of some 25,000 square miles in western Manitoba surrounding Lake Winnipeg and in the succeeding season of 1891 he explored the main streams flowing into that lake from the east. The work included actual surveying of the lakes and streams, mapping and study of the bedrock geology and investigating the glacial features and history.

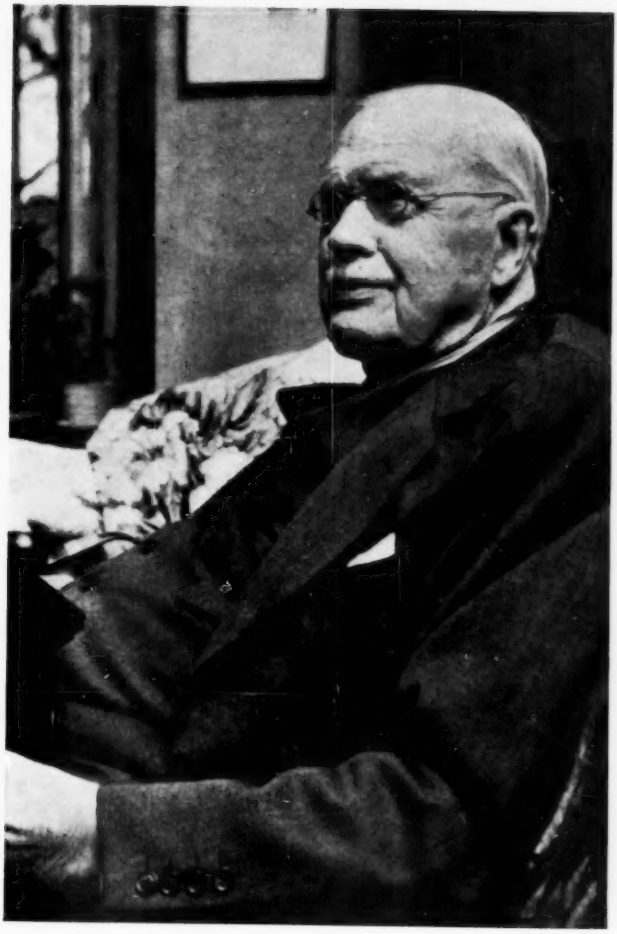
During the next three years, 1892 to 1894, Tyrrell's attention was given to the region lying west of Hudson Bay. In 1892 he explored the country between Reindeer Lake on the east and the Athabasca River on the west in which he mapped Black, Cree, Foster, and Haultain rivers and Lake Wollaston. Hearing from Indians of a great northward-flowing river which apparently traversed an area of some 200,000 square miles, about which the only information was the journal of Samuel Hearne who had crossed it on foot in the years 1769 to 1772 on his way to and from the Coppermine River country, he decided he would like to explore it. In 1893, while in Edmonton preparing for this work, he heard of a seepage of oil near Morinville, Al-

berta, and on investigating this report, he confirmed the first discovery of oil in Alberta. Proceeding to Lake Athabasca, he found his way with the aid of an Indian sketch map over a portage route to a northward-flowing stream, the Telzoa or Dubawnt River and eventually reached Chesterfield Inlet and Hudson Bay. There was still a four-hundred-mile canoe paddle down the open waters of Hudson Bay to Fort Churchill and from there a 900 mile snowshoe trip via York Factory and the Hayes River to the railway at Winnipeg. In 1894 there followed the exploration of the Kazen River which lies to the east of the Dubawnt, another descent to Hudson Bay, with once more the arduous trip to Fort Churchill and thence the overland trip to the railway, this time via Split Lake, Cross Lake, and Norway House. These journeys rank among the great feats of Canadian exploration. The geographical and geological information obtained, particularly in the field of Pleistocene glaciation, brought him world-wide recognition.

In 1898 Tyrrell was sent to make a geological survey of the southwestern part of the Yukon and to visit the newly discovered Klondike placer gold district. Later he spent seven years as a private consulting engineer in that region. Returning to Toronto he established a consulting practice and in 1925 he was appointed president of the Kirkland Lake Gold Mining Company, a positior he continued to hold until 1954.

Tyrrell's name will also be remembered for his contributions to Canadian history. His *Journals* of Samuel Hearne, Philip Turnor, David Thompson, and *Documents Relating to the Early History of Hudson Bay*, all published by the Champlain Society, are most important contributions.

In his long life he was the recipient of many honours. In 1910 he was elected a Fellow of the Royal Society of Canada and in 1915–16 he was the president of Section IV. He was a member of the Canadian Institute of Mining and Metallurgy from the year of its incorporation, 1898. He was one of the founders and the first President of the Canadian Geographical Society and remained until his death one of its Honorary Presidents. A Fellow of the Geological Society of London, England, the Royal Geographical Society of London, England, the American Geographical Society, and the Geological Society of America, he received the Murchison and Wollaston Medals from the first of these; the Back Award (a silver loving-cup) from the second; the Daly Gold Medal from the third; the Gold Medal from the Professional Engineers of Ontario; the Flavelle Medal from the Royal Society of Canada, and the Coronation Medal through the Royal Society of Canada, Section IV. He also held Honorary Memberships in the Explorers' Club, the National Geographic Society, the Arctic Institute of North America, the Canadian Institute of Mining and Metallurgy, and the Institution of Mining and Metallurgy of London, England. In 1913, he was President of the Royal Canadian Institute. In 1930 he received an LL.D. degree from the University of Toronto and in 1940 another from Queen's University, Kingston.



Joseph Burr Tyrrell

On February 14th, 1894, Tyrrell married the daughter of the Reverend G. M. W. Carey of Saint John, New Brunswick, Mary Edith Carey, who predeceased him on October 14th, 1945. He is survived by a daughter, Mrs. J. A. Dalton, of Kingston, Ontario, and by two sons, George Carey Tyrrell of Agincourt, Ontario, and Thomas Andrew Carey Tyrrell of Toronto, Ontario.

F. J. Alcock

APPENDIX C

TITLES AND ABSTRACTS OF PAPERS PRESENTED AT THE ANNUAL MEETING

PROGRAMME OF PAPERS

SECTION I. LITTÉRATURE, HISTOIRE, SCIENCES SOCIALES, ETC.

1. Les survivances françaises au Canada. Par Mgr Olivier Maurault, P.S.S., P.A., M.S.R.C.

L'auteur déclare tout de suite, que de l'œuvre civilisatrice de la France, au Canada, qui a duré 150 ans, il reste un peuple, une langue, un enseignement, des traditions et une religion. Il expose ensuite l'évolution politique de ces 65,000 Canadiens français devenus plus de 4,500,000 sous une allégeance anglaise qui a déjà duré deux cents ans; il analyse ensuite le français que nous parlons et en montre les défauts et les qualités; il attribue cette survivance à l'influence de notre système d'enseignement et à la persistance chez nous de certaines traditions; il exalte pour finir le catholicisme canadien, devenu missionnaire depuis un demi-siècle : signe non équivoque de vitalité et de maturité.

2. Joseph Royal. Par Donatien Frémont, M.S.R.C.

La carrière journalistique et politique de Joseph Royal, d'une durée de quarante ans, se déroula moitié dans sa province natale, moitié dans l'ouest canadien. Avant d'aller se fixer au Manitoba, pour y devenir le chef de la minorité française, il s'était déjà acquis un renom dans la presse montréalaise. Fondateur du *Métis*, premier président de l'Assemblée législative, ministre dans trois cabinets, il exerça un rôle prépondérant dans l'élaboration des lois de la jeune province. Passé dans l'arène fédérale, Royal y fut le porte-parole reconnu du Manitoba. Après avoir occupé durant cinq ans le poste de lieutenant-gouverneur des Territoires du Nord-Ouest, à Régina, il reprit simplement sa plume de journaliste à Montréal.

3. Etat présent des travaux sur Sophocle (1948–1958). Par Maurice Lebel, M.S.R.C.

Principales tendances des recherches sophocléennes à l'heure présente. Rétrospective littéraire et philologique des dix dernières années. Aperçu des travaux les plus importants qui ont paru en Europe et en Amérique. Manuscrits, éditions de textes, traductions, commentaires, études, représentations, adaptations. Actualité de Sophocle. Bibliographie.

4. Les Voyageurs français en Grèce au XX^{e} siècle. Par Maurice Lebel, M.S.R.C.

De Charles Maurras à René Puaux et à Jean-Germain Tricot. Le philhellénisme en France. L'élévation du récit de voyage à la dignité d'un genre littéraire. Classification des récits et impressions de voyages. Objectifs, goûts, préférences des voyageurs. Différentes conceptions de l'hellénisme : de 1900 à 1914; de 1919 à 1939; de 1945 à 1955. Bibliographie.

5. Le Dualisme religieux et syncrétisme. Par Jacques Rousseau, M.S.R.C.

Depuis la publication des travaux de l'auteur sur le dualisme religieux des Indiens chasseurs des forêts québecoises, des anthropologues ont pensé que l'on pouvait ramener au

syncrétisme le système religieux de ces Indiens. L'auteur fait une revue de toute la question.

6. Notes sur l'Entente entre Canadiens français et anglais (1910–1935). Par M. l'abbé Arthur Maheux, M.S.R.C.

L'entente est un problème moral résultat d'un processus historique.

A. *Avant 1910*

Animosités sous le Régime français

Vicissitudes sous le Régime anglais : sympathies et antipathies; influence du peuplement; influence de la clique du Family Compact; influence de la Guerre Sud-Afrique

B. *Situation en 1910*

Le sentiment canadien-français

Pleine conscience des concessions faites : acceptation du Droit anglais de la tenure anglaise; la participation aux guerres; la pression vers l'autonomie

Reviviscence du Nationalisme

C. *1910–1935*

Divisions chez les Anglo-Protestants : une partie sympathique au groupe français; une partie antipathique; orangistes, jingos, impérialistes

Divisions chez les Irlandais : une partie sympathique au groupe français; une partie antipathique; ambitions "apostoliques" (l'incident de Notre-Dame); les sièges épiscopaux; les Ecoles d'Ontario

Divisions chez les Canadiens français : une partie satisfaite du statu quo ; une partie réclame et bataille; le Règlement 17 en Ontario

La guerre 1914–18 : Gant de fer sans velours. Elite ontarienne : Moore, Clash; Morley, Bridging the Chasm; Pierce : Bonne Entente Littérature; Ferguson, Biggar : Visites interprovinciales

Réaction canadienne française : traduction du Clash (le choc); défiance pour Bonne Entente; Lorne Pierce—Camille Roy; participation, jusqu'alors refusée à divers groupements : sportifs, commerciaux, industriels, clubs, académiques, éducationnels

L'esprit d'entente se trouve alors lancé sur une meilleure voie

7. Situation de l'histoire canadienne 1900 à 1930. Par Gustave Lanctôt, M.S.R.C.

Le propos de cette étude est d'exposer la marche et l'orientation de l'histoire canadienne au cours de ces trente années. Elles furent remarquablement fructueuses : développement des archives fédérales et provinciales : création de nouveaux organes d'études historiques : et fondation de cours d'histoire dans les universités. En même temps, s'affirme un progrès dans la technique et la qualité des œuvres qui sortent des presses.

8. Les Débuts d'une ère nouvelle : les sciences (II). Par Léon Lortie, M.S.R.C.

La fondation de l'ACFAS, en 1923, est une date importante dans l'histoire des sciences au Canada. Dix ans plus tard, un pas énorme fut franchi lorsque cette association tint son premier congrès. C'était le résultat de fréquentes rencontres amicales des professeurs de sciences des universités Laval et de Montréal et le premier d'une série ininterrompue de congrès dont la valeur n'a fait que croitre depuis lors. Il fallut vaincre quelques légitimes appréhensions et mobiliser toutes les ressources disponibles, ce qui pouvait rendre difficile

la tenue d'un deuxième congrès, mais la production scientifique, une fois lancée, ne devait pas s'interrompre.

9. Les grandes associations d'éducation de l'ouest canadien. Par M. l'abbé Antoine D'Eschambault, M.S.R.C.

Il éxiste, dans chacune des provinces de l'ouest canadien, d'importantes associations de langue française qui, même si elles ont chacune leur identité, se ressemblent autant par leur origine que par le but qu'elles poursuivent. L'Association Catholique Franco-Canadienne de la Saskatchewan date de 1912. Elle a pour but la défense et le progrès de l'héritage national de nos compatriotes de la Saskatchewan et se consacre plus particulièrement à l'enseignement du français dans les écoles. L'Association d'Education des Canadiens français du Manitoba s'est toujours proposé un but exclusif : la défense des droits scolaires des Franco-Manitobains. Elle date de 1916 et a vu le jour dans des circonstances difficiles, au lendemain de la loi manitobaine qui abolissait l'enseignement du français dans les écoles publiques de la province. L'Association Canadienne français de l'Alberta, fondée en 1925, s'est tracée au début un programme plus vaste que celui des provinces sœurs, mais son action semble s'être concentrée ici aussi surtout dans le champ scolaire, tant ce domaine est menacé. Il éxiste depuis 1945 une « Fédération canadienne-française de la Colombie Britannique » dont le but est d'unir les groupements de langue française de la Colombie en un tout représentatif.

Les associations des trois provinces dites « des prairies » ont une caractéristique commune : elles se substituent aux divers départements d'éducation provinciaux auprès des écoles françaises et y accomplissent un travail identique à celui qui se fait auprès des écoles anglaises. Elles doivent tenir compte des exigences des ministères, de l'indifférence des officiels et parfois de leur hostilité. Que de problèmes! Seuls les initiés en connaissent les angoisses. C'est à la gloire de ces associations d'avoir tenu durant près de cinquante ans et de s'être développées dans le sens de leurs origines.

Le mercredi 4 juin

9 h. 30—Les Sections I et II tiendront une séance conjointe.

(1) Les grandes associations d'éducation de l'ouest canadien. Par M. l'abbé Antoine d'Eschambault, M.S.R.C.

(2) A Prelude to Self-Government: The Northwest Territories. Par Morris Zaslow. Présenté par M. F. H. Underhill, F.R.S.C.

SECTION II. ENGLISH LITERATURE, PHILOSOPHY, SOCIAL SCIENCES, ETC.

Summary of Programme

Monday, June 2

10.00 A.M. General meeting of the Society.

11.00 A.M. Presidential Address: The Revival of Conservatism in North America. By F. H. Underhill, F.R.S.C.

2.00 P.M. (1) Business meeting.

(2) Symposium: An Attack on the Crisis: The Scholar Talks Back.
W. T. Easterbrook, F.R.S.C.
G. N. Phelan, F.R.S.C.
F. M. Salter, F.R.S.C.

Tuesday, June 3

9.30 A.M. Round Tables.

1. The Humanities
   1. The Mountain Family Circle. By D. C. Masters, F.R.S.C.
   2. Christian Views of History. By Hilda Neatby, F.R.S.C.
   3. The Roman Army and the Disintegration of the Roman Empire. By E. T. Salmon, F.R.S.C.

2. The Social Sciences
   1. The Early Physiography of the North American Prairies. By F. G. Roe. Presented by F. M. Salter, F.R.S.C.
   2. Prehistoric Stone Structures on the North Shore of Lake Superior. By T. F. McIlwraith, F.R.S.C.

2.00 P.M. Symposium on "Potentialities of the Northwest." All Sections.

Wednesday, June 4

9.30 A.M. Symposium, Sections I and II: The Canadian Northwest.
1. Les Grandes Associations d'éducation de l'ouest canadien. By M. l'abbé Antoine D'Eschambault, M.S.R.C.
2. A Prelude to Self-Government: The Northwest Territories. By Morris Zaslow. Presented by F. H. Underhill, F.R.S.C.

2.00 P.M. Business Meeting.

4.00 P.M. General Meeting of the Society.

Monday, June 2

10.00 A.M.—General meeting of the Society.

11.00 A.M.—Presidential Address: The Revival of Conservatism in North America. By F. H. Underhill, F.R.S.C.

2.00 P.M.

1. Business meeting.

2. Symposium: An Attack on the Crisis: The Scholar Talks Back. W. T. Easterbrook, F.R.S.C., G. N. Phelan, F.R.S.C., and F. M. Salter, F.R.S.C.

Although not denying that there is cause for alarm in the new situation which faces us with the launching of Sputnik I and the threat of the intercontinental missile, responsible thinkers in the West cannot reconcile themselves easily to the purely technological task of "catching up with the Russians" and converting our educational system into a chain of cold war filling-stations. Perhaps our first task is not to calculate our chances of survival and the practical means to that end, but rather, to understand the meaning of the crisis—to relate what is now happening to what we know, to what we believe, and, therefore, to what we can do. A philosopher, a social scientist, and a humanist will attack the crisis in this vein—will, we trust, "talk back" to Sputnik.

Tuesday, June 3

9.30 A.M.—Round Tables.

1. The Humanities

(1) The Mountain Family Circle. By D. C. Masters, F.R.S.C.

The letters of Bishop G. J. Mountain, his family, and their friends give a vivid picture of Canadian urban culture in the middle of the nineteenth century. In their enjoyment of leisure these early Victorians led rich and varied lives.

(2) Christian Views of History. By Hilda Neatby, F.R.S.C.

This paper compares and contrasts the views of Toynbee and Butterfield on history and Christianity. It presents Toynbee as an historian looking at religion and Butterfield as a Christian looking at history. The two agree in their view of human nature and in their stern morality, but differ profoundly in method and in philosophy.

(3) The Roman Army and the Disintegration of the Roman Empire. By E. T. Salmon, F.R.S.C.

This paper seeks to prove that Roman citizens would not serve in the Roman imperial army, which consequently had to be recruited from non-citizens (induced to volunteer by promise of the citizenship). When, after 212 A.D., there were no non-citizens left, the army came to be increasingly composed of the dregs of society, who failed to defend the Empire against the barbarian assaults. Disintegration ensued.

Section II

2. The Social Sciences

(1) The Early Physiography of the North American Prairies. By F. G. Roe. Presented by F. M. Salter, F.R.S.C.

This paper presents historical evidence to prove that the western plains and the prairie regions of the North American continent were at one time wooded.

(2) Prehistoric Stone Structures on the North Shore of Lake Superior. By T. F. McIlwraith, F.R.S.C.

On exposed boulder beaches on the north shore of Lake Superior there have been found the remains of a number of crude stone structures consisting of low walls of rough boulders. The largest is 32 feet by 18 feet. The stones for the walls have been taken from within, thus depressing the original floor level. No similar structures are known in North America. They appear to have been located without reference to forested areas which suggests that they may have been caches and habitation sites of the earliest Indian immigrants at the close of the last glacial period.

2.00 P.M.—General Symposium with Sections I, III, IV and V.

Wednesday, June 4

9.30 A.M.—Symposium, Sections I and II: The Canadian Northwest.

(1) Les Grandes Associations d'éducation de l'ouest canadien. Par M. l'abbé Antoine d'Eschambault, M.S.R.C.

(2) A Prelude to Self-Government: The Northwest Territories. By Morris Zaslow. Presented by F. H. Underhill, F.R.S.C.

Complaints against limited federal aid to the settlement and development of the Northwest Territories and against government by an appointed Commissioner and Council of civil servants residing in Ottawa were heightened by the arrival of individualist, self-employed white settlers to the District of Mackenzie during the 1930's. To meet their wishes and those of sympathetic outsiders the administration was driven to modify local institutions and to consider altering the government in order to permit greater participation by residents, thus initiating a process of gradually evolving self-government which has been greatly accelerated since 1945.

2.00 P.M.—Business meeting.

4.00 P.M.—General meeting of the Society.

SECTION III. MATHEMATICAL, CHEMICAL AND PHYSICAL SCIENCES

Summary of Programme

Monday, June 2

11.00 A.M. General Meeting of Section.

2.00 P.M. Presidential Address and invited papers.

Tuesday, June 3. Sub-section meetings as follows:

9.00 A.M. Chemistry, papers 4–10.

9.00 A.M. Nuclear Physics and Cosmic Rays, papers 16–25.

9.00 A.M. General Physics, papers 26–30.

2.00 P.M. Symposium on "Potentialities of the Northwest." All Sections.

Wednesday, June 4. Sub-section meetings as follows:

9.00 A.M. Chemistry, papers 11–15.

9.00 A.M. Mathematics, Astronomy, Meteorology, papers 31–38. Physics papers to be presented by title, papers 39–42.

4.00 P.M. General Meeting of the Society.

Monday, June 2

11.00 a.m.—Business Meeting of Section.

2.00 p.m.—Presidential Address and invited papers.
A symposium on Physical Methods in Organic Chemistry.

1. Radioactive Tracers. By Léo Marion, F.R.S.C.
2. Infrared Spectroscopy. By R. Norman Jones, F.R.S.C.
3. N.M.R. Spectroscopy. By R. U. Lemieux, F.R.S.C.

CHEMISTRY

Tuesday, 9.00 a.m. Papers 4-10.

4. The Nitric Acid Oxidation of Pyrolyzed Truxene ($C_{27}H_{18}$). By J. C. Wood. Presented by O. J. Walker, F.R.S.C.

When truxene (mp. 369) is heated to 525° C for two hours it melts and then resolidifies into a shiny black mass without much loss of hydrogen. Subsequent nitric acid oxidation (235°–2 hours) yields a large portion of water-soluble acids plus a higher molecular weight water-insoluble fraction which dissolves in aqueous acetone. Analytical separations and characterizations of some of the fractions present are described in this presentation.

5. Magnesium in the Biogeochemistry of Petroleum. By Brian Hitchon and Gordon W. Hodgson. Presented by O. J. Walker, F.R.S.C.

A very large number of metals are associated with petroleum in trace quantities. While magnesium is not the most abundant it appears to occupy a very unique position. Magnesium is abundant in the petroleum source material owing to the presence of chlorophyll. In the environment of the petroleum from the time of the source material to when the oil field is discovered magnesium is very abundant relative to other metals. Nevertheless, other trace metals, particularly vanadium and nickel, apparently displace magnesium readily from the chlorophyll porphyrin structures in a developing crude oil.

6. Radiolysis of Tetrachloroethylene. By J. W. Sutherland and J. W. T. Spinks, F.R.S.C.

When tetrachloroethylene is irradiated with Co^{60} gamma rays in the presence of oxygen or air, the main products are trichloroethyl chloride, phosgene, and oxalyl chloride. The reaction is a chain reaction. Possible reaction mechanisms are discussed.

7. Primary Processes in the Mercury Photosensitized Reactions of Hydrocarbons. By R. J. Cvetanović. Presented by I. E. Puddington, F.R.S.C.

Mercury photosensitized experiments have been conducted wtih *cis*-butene-2 and *trans*-butene-2 and it was found that *cis-trans* isomerization takes place readily in the molecules which do not undergo decomposition. Both olefins are eventually converted to a 1 : 1 mixture of the two isomers. These and some other experimental results with butenes and *n*-butane provide direct experimental evidence for some of the previously postulated primary processes in the mercury photosensitized reactions of hydrocarbons.

8. Syntheses of Polyurethanes. By Paul E. Gagnon, M.S.R.C., Jean-Louis Boivin, and George House.

The main object of the present work was the preparation of polyurethanes containing nitrile groups. By treating the sodium derivative of cyanoacetic ester with ethyl chloroacetate, ethyl cyanosuccinate was obtained. This ethyl ester was then condensed with twenty-five different glycols to obtain the corresponding polyesters. The glycols employed varied in molecular weight from 60 for ethylene glycol to 4000 for polypropylene glycol. The ethanol started to form at a temperature of about 180°C and the reaction was complete after 10 hours, or 100 hours, according to the glycol employed. The pre-polymers were then transformed into polyurethanes by curing with toluene diisocyanate. The polyurethanes obtained were brittle or flexible. In general, it may be said that highly viscous or solid pre-polymers gave hard and brittle products, whereas less viscous pre-polymers gave soft and elastic products.

9. The Adsorptive Properties of a Series of Activated Cocoanut Charcoals. I. Static Experiments. By J. L. Morrison. Presented by O. J. Walker, F.R.S.C.

A series of charcoals of progressively greater steam activation was studied by measuring their adsorption isotherms for nitrogen, certain hydrocarbon gases, water vapour and

some aliphatic acids. The results are interpreted in terms of carbon structure and the nature of the activation process and are compared with those of a previously reported series.

10. The Adsorptive Properties of a Series of Activated Cocoanut Charcoals. II. Dynamic Experiments. By H. W. Habgood. Presented by O. J. Walker, F.R.S.C.

The various charcoals were used as stationary phases for gas-solid chromatography with the hydrocarbons studied in Part I. The initial slopes of the adsorption isotherms and the initial heats of adsorption were obtained from the chromatographic retention volumes. There was also qualitative evidence of variations in diffusional resistances. The limitations of this method will be discussed and the results compared with the standard nitrogen surface areas, the activities according to the accelerated chloropicrin test, and the total chloropicrin capacities.

Wednesday, 9.00 a.m. Papers 11-15.

11. The Deuterium Isotope Effect in Molecular Reactions. By A. T. Blades. Presented by O. J. Walker, F.R.S.C.

The Bigeleisen theory of kinetic isotope effects predicts in general a greater activation energy and a lower frequency factor for reactions where deuterium replaces hydrogen in the rate determining process. The application of this theory to the elimination of the hydrohalides from ethyl bromide and chloride and to a simple Chugaev reaction is discussed.

12. The Reactions of Active Nitrogen with Chloromethanes. By S. E. Sobering and C. A. Winkler, F.R.S.C.

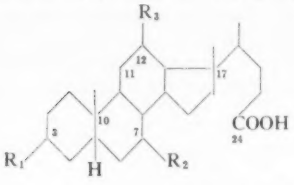
Cyanogen chloride and chlorine were the only gaseous products observed in the reaction of active nitrogen with carbon tetrachloride at 110° and 420°C. The product yields tended towards limiting values at higher reactant flow rates, and increased with increase of temperature at all flow rates. The reactions of active nitrogen with chloroform and dichloromethane at 260° and 420°C yielded hydrogen chloride and hydrogen cyanide in addition to cyanogen chloride and chlorine. The behaviour of the product yields with reactant flow rates and temperature was similar to that of the products from carbon tetrachloride.

13. The NMR-Spectra and Chemical Properties of some 1,2,3-Trisubstituted Cyclohexanes. By R. U. Lemieux, M.S.R.C. and G. Kavadias. (By title)

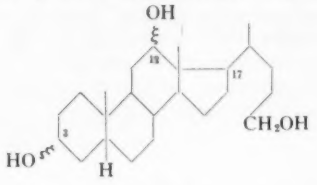
Reaction of 3-methoxycyclohexene with one mole of iodine and one mole silver acetate yielded the 3α- and 3β-methoxy derivatives of 1α-acetoxy-2β-iodocyclohexane in 20% and 70% yields, respectively. The structures and configurations of these compounds were conveniently and unequivocally established by proton magnetic resonance spectroscopy. Conformational and electronic analyses of the stereochemical routes followed in the preparation and reactions of these and related compounds will be presented.

14. Reduction of the Oximinocholanic Acids. By Ted H. Waid and Alfred Taurins. Presented by C. A. Winkler, F.R.S.C. (By title)

The reduction of several oximinocholanic acids was carried out with the objective of obtaining the corresponding amino acids. 12 β-Aminocholanic acid (I) (m.p. 115–116°) was prepared by the reduction of the 12-oximino-acid with sodium in *n*-propyl alcohol or *n*-butyl alcohol. The zwitterion structure of (I) was confirmed by the infrared spectrum which showed bands of carboxylate ion at 1550 cm^{-1} (*s*) and of $\overset{+}{N}H_3$ group at 1625 cm^{-1}. The hydrochloride of (I) (m.p. 257–258°) gave the infrared bands at 1705 cm^{-1} (*vs*) and 1610 cm^{-1} (*m*) for the carbonyl group of the free carboxyl and $\overset{+}{N}H_3$ group respectively.



I : $R_1 = R_2 = H$; $R_3 = NH_2$
II : $R_2 = H$; $R_1 = R_3 = NH_2$
III : $R_1 = H$; $R_2 = R_3 = NH_2$



IV

3α, 12β-Diaminocholanic acid (II) (m.p. 244–245°) and 7β, 12β-diaminocholanic acid (III) (m.p. 128–130°) were synthesized by similar procedures. The infrared spectrum of (II) showed bands characteristic of NH_2 (1660 cm^{-1}), $\overset{+}{N}H_3$ (1623 cm^{-1}) and COO^- (1575 cm^{-1}) groups. An analogous series of bands was observed in the infrared spectrum of (III), at slightly different positions.

The reaction of 3,12-dioximinocholanic acid with lithium aluminum hydride in tetrahydrofuran proceeded in an unusual way resulting in the formation of 3ξ, 12ξ, 24-trihydroxycholane (IV) (m.p. 166–169°). The infrared spectrum of (IV) showed a very strong band at 3340 cm^{-1} owing to the associated hydroxyl groups, and also a series of high intensity C–O stretching bands in the region of 1075–1011 cm^{-1}. The reduction of 7,12-dioximinocholanic acid with $LiAlH_4$ in tetrahydrofuran gave a compound, m.p. 234–236°, the structure of which was postulated as 7ξ-amino-12-oximino-24-hydroxycholane (V). The amino group was assumed to be located in position 7 rather than 12 because of smaller steric hindrance. The (V) was hydrolyzed by dilute acids to 7ξ-amino-12-keto-24-hydroxychlolane (VI) (m.p. 183–184°).

The infrared spectra of four ketocholanic acids (12-keto; 3,12-diketo-; 7,12-diketo; and 3,7,12-triketocholanic acids) and the four corresponding oximinocholanic acids were recorded and correlated with the structure of these substances.

15. New Methods of Dimensional Stabilization of Wood. III. Butylation of Wood. By D. F. Arseneau and J. Risi, F.R.S.C. (By title)

The substitution of the hydrophilic hydroxyl groups in lignocellulose by less polar groups increases the dimensional stability of wood. After some work on vapour-phase acetylation (Communication I), and phthaloylation (Communication II), the authors studied the effect of butylation of pyridine-swollen wood both with 1-chlorobutane and 2-chloro-2-methylpropane at various temperatures. Both methods impart stability to the dimensions of wood on a temporary basis only. The stabilizing effect is attributed to bulking. The mechanical strength characteristics are adversely affected by both *n*- and *t*-butylation.

NUCLEAR PHYSICS AND COSMIC RAYS

Tuesday, 9.00 a.m. Papers 16-25.

16. An Investigation of Time Reversal Invariance in the Beta Decay of the Neutron. By J. M. Robson, F.R.S.C., M. A. Clark, and R. Nathans.

Violation of time-reversal invariance in the beta decay of the neutron should give an asymmetry in the number of electrons emitted on each side of the proton recoil direction in a plane perpendicular to the direction of polarization of the neutron. This asymmetry is being measured using a neutron beam from the NRX reactor which is polarized by transmission through magnetized iron. The principle of the experiment will be described together with the latest data available at the time of the meeting. The data available at the date of this abstract give an asymmetry $D = -0.19 \pm 0.37$ which is consistent with both time reversal invariance, $D = 0$, or full violation of time reversal invariance, $D = +0.5$ or -0.5.

17. Absolute Thermal Neutron Fission Yields of U^{233}. By D. C. Santry and L. Yaffe, F.R.S.C.

The absolute fission yields of twenty-one nuclides formed in the thermal neutron fission of U^{233} have been measured radiochemically. Disintegration rates and half-lives were determined very accurately by $4\pi\beta$ proportional counting techniques.

Irradiations were performed in the NRX reactor at Chalk River. Neutron fluxes were predominantly thermal and were measured by the activation of a thin cobalt wire. The fission rate of U^{233} was determined in terms of

$$\sigma_{Co}/\sigma_{I_{U^{233}}} = \frac{36.3.}{524}$$

The absolute yield values were plotted to give a mass distribution curve. Previously obtained values (mass spectrometric and radiometric) were re-normalized and added to the curve.

Abnormal yields were observed at masses 91, 133, and 143. These are discussed in terms of "fine structure."

18. The Variation of Sea Level Cosmic Ray Intensity between 1954 and 1957. By A. G. Fenton, K. B. Fenton, and D. C. Rose, F.R.S.C.

The intensity of the cosmic ray flux has shown interesting variations between 1954, at a minimum of solar activity, and the end of 1957 when it approached a maximum of solar activity. The data from two stations, Ottawa (latitude 45.4N, longitude 75.6W, geomagnetic latitude 57°N) and Resolute (latitude 74.7N, longitude 94.9W, geomagnetic latitude 83°N) have been compared. At both stations a large cubical counter telescope and a neutron monitor are in operation, although the latter was not operating at Resolute throughout the whole period. The comparison of the data shows that transient changes such as Forbush type decreases, and the 27-day quasi periodic intensity changes are superimposed on a longer period change in intensity following the cycle of solar activity but in opposite sense. The mechanism producing the long period changes must be different from that producing the shorter transients since the effect on different energy components is not the same.

19. Cosmic Ray μ-Mesons Arriving at Large Zenith Angles. By B. G. Wilson. Presented by D. C. Rose, F.R.S.C.

A Geiger-counter telescope has been employed to measure the intensity of μ-mesons incident at large zenith angles. The counters were hodoscoped in pairs so that the direction of the particles could be determined to half a degree. The intensity of μ-mesons has been compared with earlier experiments and an analysis has been made relating intensity with arrival times of the particles. By means of the hodoscope it has been possible to distinguish between particles arriving from the north and from the south. An excess of μ-mesons is found to arrive from the south and this is interpreted in terms of geometrical asymmetry of the apparatus and of an actual anisotropy in the primary radiation.

20. The Photodisintegration of He^4 Nuclei. By D. L. Livesey. Presented by G. M. Shrum, F.R.S.C.

Bremsstrahlung of maximum energy 70 Mev from the beta-synchrotron at Queen's University were passed through helium gas at high pressure and the charged particles emitted were recorded in photographic plates. Over 200 tracks have been identified as being produced by He^3 nuclei from the reaction $He^4(\gamma,n)He^3$. The estimated cross-section for this process falls from (0.45 ± 0.05) millibarns at 40 Mev to approximately 0.1 millibarn at 60 Mev. The angular distribution shows that the particles are emitted preferentially at right angles to the incident beam.

21. Internal Pair Angular Correlation Apparatus. By B. L. White and W. C. Olsen. Presented by G. M. Shrum, F.R.S.C.

The multipolarity of a gamma-ray transition determines the angular correlation function $f(\theta)$ of the associated internal electron-positron pairs. Apparatus has been constructed to measure $f(\theta)$. It comprises two counter telescopes viewing the source (a UBC Van de Graaff target). The twofold telescope coincidence rate as a function of the angle θ between them, gives $f(\theta)$. Each telescope consists of a proportional counter and a plastic scintillation counter mounted within the accelerator vacuum. This arrangement allows transition energy measurements and fast coincidence techniques, has a low gamma sensitivity, and minimizes scattering effects, thus reducing distortion of $f(\theta)$.

22. Some Direct Radiative Capture Reactions. By G. M. Griffiths, P. J. Riley, L. P. Robertson, and E. A. Larson. Presented by G. M. Shrum, F.R.S.C.

Transitions of a particle from the continuum to the ground state or an excited state of the product nucleus with the emission of gamma-rays and without the formation of a compound nucleus have been studied for the reactions $D(p\gamma)He^3$ and $O^{16}(p,\gamma)F^{17}$. The targets consisted of either D_2O or H_2O frozen onto a liquid air cooled gold plate. The target thickness was obtained in terms of the stopping power for protons. Both of these reactions are of interest to stellar energy generation. The experimental results obtained will be compared with theoretical predictions.

23. The Reaction $H^3+He^4 \rightarrow Li^7+\gamma$. By J. B. Warren, P. Riley, and G. M. Griffiths. Presented by G. M. Shrum, F.R.S.C.

Radiation has been observed from the bombardment of tritium absorbed in zirconium by singly charged helium ions which, from its energy and variation of energy with the

bombarding helium ion energy, must arise from simple capture. The process appears to be one of direct interaction, the yield rising slowly and smoothly from bombarding energy of 500 Kev to 1.9 Mev by a factor of about six. About one third of the radiation corresponds to transitions through the 477 Kev state in Li^7. The absolute total cross-section at 1.6 Mev is estimated to be 3.8 10^{-30} cm^2. The angular distribution of the radiation is not isotropic, the yield at 0° being about 25% greater than at 90° to the incident beam direction for 1.6 Mev helium ions.

24. A Fast Coincidence System for the Measurement of Short Lifetimes. By G. Jones. Presented by G. M. Shrum, F.R.S.C. (By title)

An improved version of the circuit described previously (Jones and Warren, J.S.I. *33*: 429, 1956) has been constructed which is exceedingly stable with respect to time and temperature variations and on which variation of counting rate in the side channels from 300 to 7000 pp has no significant effect. The position of the centroid of the coincidence resolving curve stays within 0.1 10^{-10} sec of the mean during the course of a twenty-four hour running period. The apparatus is being applied to determine the absolute lifetimes of positrons in metals, and to see whether there are real variations in lifetime from metal to metal.

25. Experimental and Theoretical Efficiencies for Scintillation Counters. By P. P. Singh, G. M. Griffiths, and L. P. Robertson. Presented by G. M. Shrum, F.R.S.C. (By title)

Exact calculations of scintillation counter efficiencies and spectral shapes by Monte Carlo methods are very tedious and the results are specific to the crystal for which they were obtained. We have aimed at getting this efficiency data by a combination of experimental and theoretical techniques. Absolute efficiencies were obtained for Co^{60} γ-rays using a source calibrated by fast coincidence methods and for 6.14 Mev γ-rays by simultaneous α and γ-ray counting of the radiations from the F^{19} $(p, \alpha, \gamma)O^{16}$ reaction at 340 Kev. The agreement between a semi-empirical theory and experiment is better than 5% for crystals of two sizes. On the basis of this agreement the efficiencies have been calculated for the energy range 500 Kev to 20 Mev.

GENERAL PHYSICS

Tuesday, 9.00 a.m. Papers 26-30.

26. Particle Motions in Sheared Suspensions. VII. Internal Circulation in Fluid Droplets (Theoretical). By W. Bartok and S. G. Mason, F.R.S.C.

Equations are derived for the streamlines inside and outside a viscous fluid sphere suspended at the origin of an infinite body of an immiscible viscous liquid which is undergoing plane-hyperbolic deformation using a set of equations for velocity components derived by G. I. Taylor. By means of a simple transformation, the same set of equations has been used to determine the streamlines inside and outside a liquid drop undergoing laminar shear flow. Equations are also derived for the time of internal circulation for streamlines close to the surface and near the centre respectively.

27. On Change of Electrical Resistance of a Hydrophilic Film when Subjected to Voltage over a Period of Time. By C. D. Niven, F.R.S.C.

Riehl has established that the conduction in gelatin is due to proton migration but did not stress that prolonged application of voltage greatly increases the resistance. Curves illustrating this point suggest that voltage destroys or sweeps out the ions faster than they can be produced, but small effects when the polarity is reversed are not explained.

28. Thermoelectricity at Very Low Temperatures. By D. K. C. MacDonald, W. B. Pearson, and I. M. Templeton. Presented by G. Herzberg, F.R.S.C.

Earlier work (e.g., MacDonald and Pearson, Proc. Roy. Soc. A *219*: 373, 1953; *221*: 534, 1954) had shown the importance of measurements of the absolute thermoelectric power (S) on monovalent metals down to temperatures approaching the liquid helium range. In our present experiments we have measured S on all the alkali metals down to 2°K; the precision is sufficient for us to derive the Thomson heat, μ ($\mu = TdS/dT$) with some accuracy. The discrepancy with theory shown by these results appears so marked that we have now been led to extend the investigations to temperatures below 1°K. This region of temperature is accessible by adiabatic demagnetization of a paramagnetic salt and naturally presents technical problems of a particular character. A number of experiments are already complete, and show clearly that measurement of thermoelectricity below 1°K presents a challenging and most interesting field.

29. Galvanomagnetic Behaviour of Conductors under Extreme Conditions. By Gaston Fischer and D. K. C. MacDonald. Presented by G. Herzberg, F.R.S.C.

Following the pioneer investigations of Kapitza using very high-pulsed magnetic fields (Proc. Roy. Soc. A *115*: 658, 1927; *119*: 358, 1928; *123*: 292, 1929), Sommerfeld and Bethe pointed out in 1931 that theory could only give a very qualitative account of magneto-resistance in metals. More recent investigations (cf., e.g., MacDonald, Proc. 5th Intl. Low Temp. Conf. (Madison), 1957) have used very low temperatures, high purity metals, and moderately high steady magnetic fields (up to about 30–40 KOe) to achieve large values of the ratio l/r (l: electron mean free path; r: radius of free electron orbit in applied magnetic field). It remains true that the theory appears inadequate today to explain metallic behaviour.

On the other hand, measurements of Hall voltage and magneto-resistance in a semiconductor such as InSb, where we can achieve $l/r \gg 1$ at ambient temperatures, are on the whole well interpreted by the Wilson "two-band" model (Fischer and MacDonald, Phil. Mag. *2*: 1393, 1957; Can. J. Phys. *36*: 527, 1958). Since in metals the electron density is much greater than in semiconductors, one is tempted to assume that electron-electron interaction must be an important factor; the recent theoretical work of Bohm and Pines on electron correlation (Phys. Rev. *92*: 609, 626, 1953; Can. J. Phys. *34*: 1379, 1956) may be significant here.

Further measurements are being made on InSb, and we expect to make experiments on other semiconductors.

30. The Non-Martensitic Diffusionless Transition in MnAs at about 40° C. By Z. S. Basinski and W. B. Pearson. Presented by G. Herzberg, F.R.S.C.

Manganese arsenide is known to have a transition at about 40°C at which there is no change of structure from the nickel arsenide type, but in which the a axis of the unit cell and the electrical resistivity change discontinuously. The phase stable below the transition is ferromagnetic and that above is paramagnetic.

We have examined the nature of this discontinuous transition and find that individual subgrains transform completely in less than 50 μsec, from which we can conclude that the transformation is diffusionless. However, microscopical and X-ray observations show none of the characteristics of a martensitic transformation. As MnAs is very brittle and has no known mechanical twins, it appears likely that it cannot be plastically deformed. The change apparently cannot therefore proceed by the subtle mechanism of a martensitic transformation in which the strain energy is minimized by fitting the parent and daughter phases on a habit plane, but which involves some plastic deformation of the daughter phase. The strain energy of the transformation in MnAs is minimized by a fragmentation of the crystal grains into pencil-like subgrains. As the expansion of the a axis produces dilatational stresses which are maximum across the planes parallel to the c direction, the axis of the pencil-like subgrains would be expected, and is found, to lie along this direction.

Specific heat measurements throughout the transition region differ from those previously reported and appear consistent with a first order transition having a very small latent heat.

MATHEMATICS, ASTRONOMY, METEOROLOGY

Wednesday, 9.00 a.m. Papers 31-38.

31. Some Properties of Complex Conformal n-Space. By Peter Scherk, F.R.S.C.

The author defines conformal mappings T in complex conformal n-space and discusses their decompositions into similarities and inversions. The results differ from the classical real case inasmuch as T can not always be expressed as the product of a similarity with an inversion. The exceptions are investigated, related decompositions of T are studied, and a simple proof is obtained that T is the product of inversions.

32. Coverings of Bipartite Graphs. By N. S. Mendelsohn, F.R.S.C. and A. L. Dulmage.

With respect to any bipartite graph the notions of exterior coverings and interior pairs are defined. In terms of these it is possible to give a canonical decomposition of any graph and thus classify the points.

33. The Stochastic Rank of a Matrix. By N. S. Mendelsohn, F.R.S.C. and A. L. Dulmage.

Let B be a matrix of n rows and columns whose entries are non-negative. B is said to have stochastic rank σ if B can be embedded in a doubly stochastic matrix C having

$2n - \sigma$ rows and columns. If S represents the sum of all the entries in B, M the maximum sum in any row or column of B and ρ the term rank of B, then: (a) $\rho \geqslant \sigma$; (b) If B is doubly stochastic or a sub-permutation matrix $\rho = \sigma$; (c) $\sigma = [S/M]$; (d) If S/M is an integer $\rho \geqslant \sigma + 1$. Further results, connecting the row sum of C with the size of the extension are obtained.

34. The Eclipsing Variable H.D. 190786 (V477 Cygni). By Joseph A. Pearce, F.R.S.C.

Spectrographic orbital elements for this eclipsing variable were computed from thirty-five observations. Although the primary component is two magnitudes brighter than its companion, it was possible to measure the lines of the secondary star on fourteen plates secured when the relative separation exceeded 200 km/sec.

The elements are:

$P = 2.347016$ days, $T =$ Hel. J.D. $2{,}433{,}843.9995 \pm 0.0367$,
$e = 0.235 \pm 0.007$, $\omega_1 = 152°.7 \pm 2°.19$, $\omega_2 = 332°.7 \pm 2°.19$,
$V_0 = -18.8 \pm 0.65$ km/sec, $K_1 = 105.0 \pm 0.90$ km/sec, and
$K_2 = 155.7 \pm 1.24$ km/sec.

The photoelectric light curve by Wallenquist enabled the following absolute dimensions to be deduced:

$i = 88°.5$, $A = 8.180 \pm 0.068 \times 10^6$ km;
primary star, A3, $M_v = +2.09$, $R = 1.46\odot$, $m = 2.37\odot$, $\rho = 0.76\odot$;
secondary star, F5, $M_v = +3.73$, $R = 1.16\odot$, $m = 1.60\odot$, $\rho = 1.02\odot$.

The line of apsides is advancing with a value of

$$\omega = 102°.7 + 0°.825\ (t - 1900),$$
$$\pm 0.11 \quad \pm 0.022$$

in a period of 436 ± 12 years.

The observed rotational effect of 31.1 ± 1.7 km/sec during the primary eclipse indicates that the axial rotation is identical with that of the orbital revolution.

35. H.D. 23642, A Spectrographic Binary in the Pleiades Cluster. By Joseph A. Pearce, F.R.S.C. (By title)

This is the first spectrographic binary in the Pleiades for which orbital elements have been computed. From the measures of both components on twenty-one single-prism spectrograms the elements are:

$P = 2.46399$ days, $e = 0$, $T =$ J.D. $2{,}432{,}758.0700$,
$V_0 = +6.8 \pm 1.64$ km/sec, $K_1 = 100.6 \pm 2.56$ km/sec, $K_2 = 148.9 \pm 3.37$ km/sec.

Absolute magnitudes of $+0.83$ and $+1.94$ were determined spectroscopically for the A-type components. From the mass-luminosity relationship for spectrographic binaries, an inclination of 70° for the orbital plane and actual masses of $2.9\odot$ and $1.9\odot$ were deduced.

The radial velocity, the proper motion, 0″.043 in position angle 156°.3 and the parallax, 0″.007, definitely establish the membership of this binary in the Pleiades cluster.

36. Propagation in an Infinite Elastic Plate. By J. W. C. Sherwood. Presented by L. E. Howlett, F.R.S.C. (By title)

Previous work has shown that in an infinite elastic plate at any one frequency there exist only a finite number of eigenvibrations with a real propagation constant (unattenuated vibration and finite phase velocity) and an imaginary propagation constant (exponentially

attenuated vibration with finite phase velocity). An infinite number of eigenvibrations are, however, necessary for the description of an arbitrary force distribution in a driven plate. This work shows that an infinite set of eigenvibrations does exist and that these possess complex propagation constants. The vibrations vary exponentially with distance and have a finite phase velocity. They do not involve energy dissipation.

37. Synoptic Studies of Hail Occurrences in Alberta. By D. H. Smith and C. E. Thompson. Presented by A. Thomson, F.R.S.C.

Brief synoptic studies have been made of hail occurrences during the summers of 1955, 1956, and 1957. The results tend to show that for severe storms of the tracking type there must be a marked cooling in the intermediate layers of the atmosphere. It is also necessary that there be sufficient moisture content in the lowest layer of the atmosphere.

38. A Study of Hailstorms in Alberta. By R. H. Douglas, Walter Hitschfeld, and J. S. Marshall, F.R.S.C.

During the summer of 1957 detailed radar records were obtained of thunderstorms in central Alberta. In addition, over 3,000 hail reports, covering seventy-seven hail days, were received from within the project area. Visual cloud development was recorded by time-lapse photography. The three-dimensional patterns of the thunderstorms, and their development with time, have been derived from the radar records. Correlation of these with the surfcae hail reports permits a comparison of the hail-producing storms with the others, and enables a tentative fitting of the phenomenon of hail formation into the life cycle of the storm.

PHYSICS

Wednesday, 9.00 a.m. Papers 39-44.

39. A Mass Spectrometric Study of Normal Oxygen and Oxygen Subjected to Electrical Discharge. By J. T. Herron and H. I. Schiff. Presented by C. A. Winkler, F.R.S.C. (By title)

A mass spectrometric study was made of oxygen activated by microwave and by a.c. glow discharge. Appearance potential curves for normal oxygen at masses 16 and 32 indicated the occurrence of multiple electron impact processes. The change in the curves when the oxygen was activated could be interpreted by assuming the presence of oxygen atoms in the ^3P ground state, and O_2 molecules in the $^1\Delta_g$ excited state. No evidence was obtained for the presence of ozone up to pressures of 2 mm Hg. The recombination coefficient of O-atoms on pyrex was found to be 1.1×10^{-4}. Only one oxygen atom in 21 was ionized before recombining in the mass spectrometer ion source. The rate constant for the reaction of O-atoms with N_2O is less than 1×10^{-8} cm^3 mole^{-1} sec^{-1}, and several orders of magnitude less than this for the reaction $O(^3P) + N_2O \rightarrow 2NO$. The reaction of O-atoms with NO_2 was much faster than with NO, but no evidence was found for the formation of NO_3.

40. Application of a Three-Band Model in Consideration of the Electrical Properties of Te and Bi_2Te_3. By E. Mooser and W. B. Pearson. Presented by G. Herzberg, F.R.S.C. (By title)

Consideration of the co-ordination, interatomic distances, and valence states of the Group V to VIIB elements and compounds formed between them, reveals that in many

cases the chemical bonds to atoms in the second co-ordination sphere of any given atom are stronger than the van der Waals type. This implies that some valence electrons are involved in the bonding and because of the electronic structure of these elements "higher" *d* orbitals must be used for this bond formation. We believe that an admixture of pivotally resonating hybrid bonds (say p^3d^3) to the bond scheme of the elements concerned gives a consistent explanation of the interatomic distances, co-ordination and stoichiometric formulae of this class of substance as well as of the variation of the electrical properties with temperature and on melting. When these pivotally resonating bonds occur between next nearest neighbours *in the structure of elements* or *between anions and anions in compounds*, the conditions for "semi-conducting bonds" (cf. Mooser and Pearson, J. Electronics *1*: 629, 1956) are no longer fulfilled. An admixture of these pivotally resonating bonds results in the band picture in a band of low state density which overlaps the "normal" valence and conduction bands of the substances. In tellurium and *n*-type Bi_2Te_3, for instance, the presence of this third band, which we have been led to postulate from considerations of the crystal chemistry of these substances, leads to an explanation of the multiple reversals of Hall coefficient as a function of temperature, with the further addition only of rather plausible assumptions of band shapes and relative carrier mobilities. In other substances formed between the Group V to VIIB elements as, for instance, in the $D5_8$, BiI_3 and BiSCl types of compounds, our chemical reasoning leads to the conclusion that the band models and semi-conducting properties are normal.

41. Pressure Gradient-to-Pressure, Mechanical Sound Transducer. By T. F. W. Embleton and G. J. Thiessen. Presented by L. E. Howlett, F.R.S.C. (By title)

In places of high ambient noise level where communication by electrical means is precluded, an aid to speech communication is a mechanical close-talking microphone used in conjunction with ear defenders. This consists, on the outside of the ear cover, of a diaphragm (responding to the pressure gradient of the sound field) which is coupled mechanically to a second diaphragm on the inside of the cover. Sentence intelligibility tests on fifty people showed that for an articulation index of zero the median subject obtained a score of 28% using ear covers alone and 84% with the sound transducer.

42. Acoustic Momentum Flux and Radiation Pressure. By J. S. Pyett. Presented by L. E. Howlett, F.R.S.C. (By title)

The explanation of acoustic radiation pressure in terms of momentum flux, often given for problems in one dimension, has been extended to cover some problems in three dimensions. The case of a small spherical obstacle in a plane progressive wave has been treated specifically, the force due to radiation pressure on the sphere being obtained by considering the momentum flux in the primary field and in the secondary (scattered) field. The force is in general not proportional to the scattering cross section.

43. Relationships between the Secular Change of the Earth's Magnetism and The Non-Dipole Fields. By K. Whitham.

Using Canadian magnetic charts for epoch 1955.0 estimates have been made of the drift contributions of the non-dipole field to the secular variation. The drift rates which produce the minimum residual secular variations were found to be unusually small. The small rate of westward drift was then confirmed, using the longitude displacement method.

These results clearly demonstrate the large local fluctuations which occur in westward drift.

The two methods were applied to obtain relationships between the Gaussian coefficients in the spherical harmonic analyses of the geomagnetic field and the secular variation. Both methods are shown to be equally capable of giving the accepted world-wide average value of westward drift. At least one half of the world-wide secular variation can be produced by westward drift.

44. Couette Flow in an Axial Magnetic Field. By E. R. Niblett.

Chandrasekhar's theory of the stability of viscous flow of an electrically conducting fluid between co-axial rotating cylinders with perfectly conducting walls is here extended to include the case of non-conducting walls, and it is found that their effect is to reduce the critical Taylor numbers and increase the wavelengths of the instability patterns by considerable amounts. An experiment designed to measure the values of magnetic field and rotation speed at the onset of instability is described. In this experiment the fluid used was mercury and radioactive isotopes of this element were used to trace the flow. The results indicated that the boundary conditions can have a large effect on the critic Taylor numbers and the wavelengths associated with the instability patterns.

INDEX, SECTION III

Light-face figures indicate the number of the article, bold-face figures the number of the page.

SECTION IV. GEOLOGICAL SCIENCES

Monday, June 2

11.00 A.M.—Meeting of the Section.

1. Presidential Address by H. C. Rickaby, F.R.S.C.

2.00 P.M.

2. Regional Cross Sections of the Interior Plains, Canada. By Wm. C. Gussow, F.R.S.C.

It is anticipated that preliminary copies will be available for display during the annual meeting of the Society in Edmonton. It is proposed to discuss the historical geology of the Plains and point out some of the major geological features, both structural and morphological, such as the Alberta monocline, Williston Basin, Sweetgrass Arch, Peace River buried mountains (2000 feet in elev.), buried Mississippian escarpment (200 feet to 300 feet), Cypress Hills, Middle Devonian evaporite basin (three salt members), Upper Devonian reefs, regional unconformities, and buried topography, etc., as well as several oilfields.

The sections extend from the Foothills and Front Ranges of the Rockies to the Precambrian Shield.

3. Cordilleran Tectonics of British Columbia. By William H. White. Presented by V. J. Okulitch, F.R.S.C.

The tectonic history includes four major depositional sequences and no less than *six* major epochs of orogeny. During Proterozoic and Palaeozoic, three eugeosynclines subsided in succession, each in turn destroyed by orogeny. The last major subsidence, in Lower Mesozoic, was in part accompanied and followed by "Coast Range orogeny"—a protracted succession of syntectonic sedimentation, folding, faulting, and serial development of the great granitic complexes of the Province. Closely following Coast Range orogeny and separated from it by no major subsidence, "Rocky Mountain orogeny" was expressed by strong deformation of miogeosynclinal and shelf sediments east of the main seaways. Tertiary tectonic events were widespread and complicated but comparatively less severe than earlier events.

4. The Nicanassin Luscar Hiatus in the Canadian Rockies. By P. S. Warren, F.R.S.C. and C. R. Stelck.

The basal Nikanaassin of the type section in the Central Alberta foothills is known to yield fossils referable to the Oxfordian stage of the Jurassic. Floras with Luscar affinities are known to occur above Neocomian (Lower Cretaceous) marine deposits in the Peace River area. In type area the unconformable boundary between the Nikanassin and Luscar formations is defined by the Cadomin conglomerate. The hiatus indicated by this unconformity is represented in the Peace River basin by a continuous sequence of *Aucella*-bearing beds of the Upper Nikanassin (Upper Jurassic) and lower Bullhead (Lower Cretaceous) group of formations.

5. A Geophysical and Petrological Study of the Precambrian Basement of Alberta.

(1) Features Inferred from Gravity Measurement. By G. D. Garland. Presented by H. Grayson-Smith, F.R.S.C.

Measurements of gravity over the plains and foothills indicate that the gravity field in these areas is largely controlled by the lithology of the Precambrian basement. The

interpretation of the effects in conjunction with petrological studies on samples from wells reaching the Precambrian allows a lithologic map of the basement to be produced. By this means the covered Shield has been traced to beneath the main ranges of the Rocky Mountains, and the uplift of it produced by the frontal thrusts of the mountains has been estimated.

(2) Petrology and Age Determination. By R. A. Burwash. Presented by P. S. Warren, F.R.S.C.

Recent age-dating by the potassium-argon method of biotites separated from basement cores has given ages ranging from 1,600 to 2,000 million years. Most samples give dates of 1,800 to 1,900 million years. A large part of the basement in Alberta is thus related to the Churchill geologic province.

6. Topography of the Precambrian Basement in Northern Alberta. By R. Green. Presented by R. E. Folinsbee, F.R.S.C.

A map has been constructed showing basement topography at the end of Devonian time. The pre-Devonian basement topography was one of low relief. The highest area of the surface was along the British Columbia–Alberta border to the southwest of the Clear Hills. From here the surface sloped down to the north at a rate of 100 feet to the mile, and to the east and southeast at a rate of twenty feet to the mile. Several probable broad river valleys are visible. No obvious structural features are apparent.

7. Some Fundamental Considerations in Fracture Analysis Research. By J. D. Mollard. Presented by R. E. Folinsbee, F.R.S.C.

Aerial mosaics reveal similar fracture patterns on exposed bedrock and on Pleistocene materials in the plains regions of Western Canada. Individual fracture traces represent linear elements in the vegetation, in soil tones, drainage and relief. Many details of the resulting pattern are not satisfactorily explained by wind, wave, current or glacial activity.

Pertinent geologic literature concerning regional systematic fractures in sedimentary materials is reviewed in the light of characteristics of fracture patterns mapped from aerial photographs. Mechanisms are suggested to explain certain features of these apparently inherited patterns. Some applications of fracture analysis and interpretation are given.

8. Aerial Photographic Interpretation of Precambrian Structures North of Lake Athabasca, Alberta. By John D. Godfrey. Presented by R. E. Folinsbee, F.R.S.C.

Study of aerial photographs over 3,600 sq. miles along the margin of the Precambrian Shield in northeastern Alberta has been undertaken. The main structural elements and types have been outlined. The topographic expressions of these features are discussed in relation to the lithology of the Precambrian rocks and continental glaciation. Minor complex dune formations have been noted. Spot checks of structural elements and rock types have been possible in the course of a reconnaissance survey during the field season of 1957.

Tuesday, June 3

9.00 A.M.

9. The Jurassic System in Northern Canada. By Hans Frebold, F.R.S.C.

This paper outlines the stratigraphy, palaeogeography, and faunal composition of a number of Jurassic occurrences in northern British Columbia, the Yukon and the Canadian Arctic,

based on collections made during the past few years. The sequence of events during the Jurassic is shown to differ considerably in these various regions. Faunistic and stratigraphic correlations are made with other parts of Canada, the United States, Europe, and Arctic regions other than Canada.

10. Mammal Teeth from the Edmonton Formation at Scabby Butte, Alberta. By Loris S. Russell, F.R.S.C.

The small plateau with dissected western face, situated about three miles east of Nobleford, and just south of Kehoe Lake, is known in geological literature as Scabby Butte. The rocks exposed here correspond to the lower part of the Edmonton formation. Here dinosaur remains were found for the first time in Alberta, and here important fossil vertebrates have been found in recent years by collectors from the National Museum of Canada. The collection includes skulls of the bizarre ceratopsian *Pachyrhinosaurus*. During the field season of 1957, Dr. W. Langston, Jr., discovered an occurrence of small teeth and bones. Washing sediments from the site revealed, among other things, two lower molars of mammals. These do not closely resemble any of the opossum-like lower molars previously found in the Edmonton and Oldman formations. One of these teeth is almost certainly that of an insectivore, closely related if not belonging to the family Leptictidae. The other tooth, incomplete, is from a different mammal, but may also represent an insectivore. If these teeth are truly those of insectivores, they are the oldest relics of placental mammals found so far in North America.

11. Mississippian Lithostrotionid Biozones of the Southern Canadian Rockies. By Samuel J. Nelson. Presented by P. S. Warren, F.R.S.C.

Lithostrotionid species of the Banff, Livingstone, Mount Head, and Etherington formations are described and arranged according to zones. In ascending order zonation is: the *Lithostrotionella jasperensis* zone of the upper part of the middle member; and the *Lithostrotionella micra* and *Lithostrotion mutabile* zones of the upper member of the Banff (Shunda); the *Lithostrotion sinuosum* zone of upper Livingstone; the *Lithostrotionella* n. sp. and *L. astraeiformis* zones of lower Mount Head; the *Lithostrotion whitneyi* zone of middle and upper Mount Head; the *L. "arizelum"* zone of uppermost Mount Head; the *L. genevievensis* zone of lower Etherington; and the *Lithostrotionella* n. sp. zone of upper Etherington.

12. Brachiopod Zones of the Mount Head and Etherington Formations, Southern Canadian Rockies. By Samuel J. Nelson. Presented by V. J. Okulitch, F.R.S.C.

Brachiopod assemblages from the Mount Head (Meramecian) and Etherington (Chesterian) formations are arranged according to zones. Zones recognized are the *Spirifer bifurcatus*, *Echinoconchus biseriatus*, and *Girtyella indianensis* of lower, middle, and upper Mount Head, respectively; the *Gigantoproductus brazerianus* zone of uppermost Mount Head and lowermost Etherington; and the *Dictyoclostus parvus*, *Punctospirifer transversa* and *Diaphragmus cestriensus* zones of lower, middle, and upper Etherington, respectively. A possible higher zone, the *Spirifer matheri*, found at one locality suggests that the uppermost Etherington may be, in part, Pennsylvanian.

Type Tunnel Mountain formation is thought to be Pennsylvanian in age, not Chesterian as commonly asserted.

13. A Local Population of Encrinurus. By R. V. Best, A. H. Brackenridge, and J. N. E. Weber. Presented by H. S. Armstrong, F.R.S.C.

Over a hundred specimens from a three-foot interval in the upper Lockport, including cranidia, cheeks and hypostomes, although differing somewhat from the types, represent a local population of *E. reflexus* and are used to amplify Raymond's 1916 definition of the species.

Diversity in development of axial pustules, of number of ribs and of particular patterns of rib pustules is used to illustrate the range of intraspecific variation.

14. Carbon-14 Age Determinations. By W. Dyck and K. J. McCallum, F.R.S.C.

The determination of the carbon-14 content of naturally occurring materials at the University of Saskatchewan was based formerly upon counting samples in the form of solid carbon. Due to various difficulties with this technique, gas proportional counting methods have now been introduced. The carbon from the sample is converted into acetylene gas, which is introduced into a gas counter for radioactivity measurements.

Some of the results of age determinations of carbon-containing materials which have been obtained will be presented.

15. Palaeogeochemistry of Crude Oils and Connate Waters in Selected Ancient Basins of Western Canada. By Brian Hitchon and Gordon W. Hodgson. Presented by P. S. Warren, F.R.S.C.

Collected analyses of crude oils and their associated connate waters from selected portions of the geologic column of the Western Canada sedimentary basin indicate that a general relationship exists between the conditions of deposition of the sediments and the accumulating crude oil and associated connate water.

2.00. PM.—Symposium on "Potentialities of the Northwest." All Sections.

Wednesday, June 4

9.00 A.M.

16. Structural Features of the Northern Part of the Labrador Trough. By René Béland and P. E. Auger, F.R.S.C. Presented by I. W. Jones, F.R.S.C.

Most of the Labrador Trough is pictured as an asymmetrical geosyncline which began as a half graben. But the Payne Bay–Roberts Lake segment is a semi-isolated basin along the rim of which the same sedimentary formations outcrop continuously.

The structural lineaments in the basin have the same attitudes as in the main part of the Trough at Leaf Bay. Along the east side dips are steep, with overturning, and contacts are sheared. Along the west side the rocks are less deformed, and the folding has been influenced as much by the shape of the Archean floor as by tectonic shoving from the Northeast.

At Ford Lake, the thicker parts of the iron-formation lie in embayments and show evidence of lagoonal deposition.

17. Crystalline Limestones in Northern Ontario and Manitoba. By H. S. Armstrong, F.R.S.C.

Although carbonate bodies, regarded as being of replacement origin, have been mapped with the volcanic sequence in a number of areas, carbonate rocks of sedimentary origin are commonly thought to be absent from the typical "Archean" assemblage in the Canadian Shield. Sedimentary carbonate rocks, however, have been recorded in several areas near latitude 53 degrees north in Ontario, and farther north in Manitoba. The rock associations in these occurrences are briefly reviewed, and some possible geological implications discussed.

18. The Geochemistry and Origin of Carbon Dioxide Water, Sulphur, and Boron in the Yellowknife Gold Deposits, Northwest Territories, Canada. By R. W. Boyle, F.R.S.C.

The gold deposits of Yellowknife occur in two distinct geological settings. The principal economic deposits occur in quartz-carbonate lenses in extensive chlorite schist zones (shear zones) cutting greenstone (amphibolite) rocks. The other deposits, of less economic importance, occur in quartz lenses in meta-sedimentary rocks.

Geochemically, the deposits in the greenstones represent concentrations of silica, carbon dioxide, water, sulphur, arsenic, antimony, gold, and other metallic elements. Those in the sediments represent concentrations of silica, sulphur, boron, gold and other metallic elements.

For the deposits in the greenstones chemical evidence is presented to show that, under the influence of a strong thermal gradient promoted by granite emplacement, the carbon dioxide, water, and sulphur in the original volcanic rocks were mobilized and migrated into the extensive shear zone systems. In the shear zones the chemical equilibrium was severely displaced, water and carbon dioxide reacted with the amphibolite rock producing extensive widths of chlorite and chlorite-carbonate schist, and silica, sulphur, gold and other elements present in the rock were mobilized. These mobilized elements and compounds migrated into dilatant zones such as shear zone junctions and were precipitated as quartz, sulphides, and gold.

A similar process has operated to form the gold-quartz lenses in the meta-sediments. In these rocks silica, boron, sulphur, and metallic elements have been mobilized during the metamorphism of the sediments, and these have migrated into and been precipitated in dilatant zones in faults, fractures, and drag folds in the rocks.

[Abstract published by permission of the Director, Geological Survey of Canada, Department of Mines and Technical Surveys, Ottawa, Canada.]

19. Readily Extractable Copper in Rocks as a Guide for Prospecting. By Harry V. Warren, F.R.S.C. and Robert E. Delavault.

This investigation explores the possibility of ascertaining the mineral potentialities of an area around an outcrop of limited size using rock analyses involving a chemical attack of moderate intensity.

By using hot aqua regia, which does not substantially attack silicates, encouraging variations in the copper content of plutonic rocks have been noted.

In general, our preliminary results suggest that, in the vicinity of mineralization, the readily extractable copper of plutonic rocks is from five to ten times greater than that from rocks unrelated to mineralization.

This technique may prove useful in exploration and prospecting.

20. Geology and the International Geophysical Year. By J. A. Jacobs. Presented by H. C. Gunning, F.R.S.C.

The impact of the International Geophysical Year on geology and geological thinking is discussed. Although the main purpose of this major scientific undertaking is geophysical, much value can accrue to geology. Specific examples are drawn from the satellite programme and the fields of geomagnetism, glaciology, seismology and gravity.

21. Palaeomagnetism and Continental Drift. By P. M. DuBois. Presented by S. C. Robinson, F.R.S.C.

Palaeomagnetic measurements from several different continents are discussed. If the earth's magnetic field, averaged over a long period of time, is assumed to be that of a central dipole oriented along the earth's axis of rotation, then comparisons between palaeomagnetic measurements from different continents indicate that large relative movements between the continents have taken place. The basic assumption about the axial and dipolar nature of the earth's average magnetic field is theoretically reasonable and is supported by the experimental results from the Tertiary.

22. Seismological Evidence for the Tectonics of the North West Pacific Ocean. By Adrian E. Scheidegger. Presented by W. C. Gussow, F.R.S.C.

From a series of fault plane solutions of earthquakes in any one area, it is possible to determine the tectonic displacement of that area by a least squares solution. This method has been applied to the areas marginal to the North West Pacific Ocean. It turns out that the directions of the tectonic displacement in the Kurile Islands, Honshu, the Marianas Islands and the Philippines are more or less parallel: the direction is approximately north 14 degrees west. It thus appears that the whole North West Pacific Ocean is moving *en bloc* with regard to its margin.

23. Mineral Deposits and Fuels in Northwestern Canada. By A. H. Lang, F.R.S.C. and R. Douglas. (By title)

24. The Education of a Geologist. By G. B. Langford, F.R.S.C.

4.00 P.M.—General Meeting of the Society (Convocation Hall, Arts Building).

SECTION V. BIOLOGICAL SCIENCES

Monday, June 2

11.00 A.M.—Business Meeting of Section (Room Med. 142).
2.00 P.M.—General Session and Botany and Zoology (Room Med. 142). Medical Sciences (Room Agr. 241; Room Med. 375). Papers 1–11.

1. Presidential Address by Walter R. Campbell, M.D., F.R.S.C.

2. On the Mechanism of Root-Hair Development. By R. G. H. Cormack, F.R.S.C.

Many years ago, the writer pointed out marked differences in the condition of the root epidermis and in the initiation and development of root-hairs. A theory of root-hair development was formulated based on the gradual hardening of the outer pectic layer to calcium pectate. Quite recently this theory has been disputed and another put forward that the wall is hardened by the thickening of cellulose strands alone. The problem of root-hair initiation has been reinvestigated and the present paper discusses the features of both theories.

3. Quelques Entités nouvelles de la flore du Québec. Par Jacques Rousseau, M.S.R.C.

Les entités mentionnées dans le travail présenté comprennent : (1) des formes non décrites de la flore du Québec, et particulièrement de l'Ungava; (2) une revue de toutes les formes mineures déprimées de nos conifères et description d'entités nouvelles; (3) des espèces non encore signalées de la flore du Québec.

4. Physioiogical Adaptations of Insects for Winter Survival. By R. W. Salt. Presented by N. H. Grace, F.R.S.C.

Two distinct types of cold-hardiness enable insects to survive low winter temperatures. Toleration of freezing within the body is effected through the production of protective substances such as glycerol. Avoidance of freezing is effected by supercooling, but this has limits imposed by temperature, time, and certain physical characteristics of the insect. The latter pertain chiefly to interfaces between water and substances contained in it, the ensuing surface energy relationships, and the influence of these on the ability of non-aqueous surfaces to initiate freezing.

5. A Biochemical Approach to Fisheries Research. By H. L. A. Tarr, F.R.S.C.

The biological approach to fishery research has largely involved classification, population studies, or investigations concerning methods of capture. There has, however, been an ever increasing interest in the physiology of fishes and significant contributions have been made in determining the effects of external physical and chemical stimuli, or of hormone influence, on the development and behaviour of fish. In comparison, biochemical and chemical studies of marine forms have been rather sporadic and scattered, and these

have been frequently influenced by purely utilitarian aspects. Several of the unique opportunities which fishery research offers to the biochemist and the organic chemist will be outlined.

6. Age-classes and Sex Proportions of Fraser River Sockeye Salmon during the Period 1915 to 1957. By W. A. Clemens, F.R.S.C.

Random sampling of the sockeye salmon proceeding to the Fraser River throughout the period 1915 to 1957 has shown the presence of several year classes which occur in varying percentages and sex proportions. Factors related to these variations are discussed.

7. The Proteins of Hen Egg Yolk. By W. H. Cook, F.R.S.C.

Two proteins and two lipoproteins are said to represent most of the protein material in egg yolk. The homogeneity of these fractions has not been established and one of the proteins may have been derived from a lipoprotein. The work to be presented has established the existence of four proteins and two lipoproteins in major proportions and each of these has been characterized physically. Lipovitellin has been difficult to purify since it occurs as a complex with two other proteins, and lipovitellenin is heterogeneous, although it apparently contains only one protein moiety.

8. Biological Assays as Titrations. By H. J. Bell and L. B. Jaques, F.R.S.C.

The assay of heparin has caused difficulties in most laboratories. The assay methods measure the inhibition of coagulation in blood or plasma. In the treatment of such measurements, some have approached this as a biological assay and some as a chemical determination. The authors have examined the various methods and principles involved and conclude that all the methods are titrations with a broad end-point. The implications for biological assays of this conclusion will be discussed, particularly with regard to criteria of acceptance and rejection of data, and the application of statistical methods.

[Supported by the National Research Council of Canada.]

9. Palaeobotanical Evaluation of Fossil Wood in Onakawana Lignites. By Norman W. Radforth. Presented by G. Krotkov, F.R.S.C.

The occurrence of *Cupressinoxylon* sp. determined as a major component in the Onakawana lignites is discussed. A preliminary attempt is made to assess the relationship of the macrofloral mass to the microflora with new evidence for the occurrence of the latter now at hand.

10. Polarity in the Early Embryogeny of *Ginkgo Biloba* L. By Norman W. Radforth, Peter Trip, and Hans Bonga. Presented by G. Krotkov, F.R.S.C.

Post zygotic embryonic masses of *Ginkgo* when developed *in vitro* indicate that polarity does not necessarily arise parallel with the archegonial axis of the archegonium as in the *in vivo* condition. Forms of development of the embryonic growth preceding differentiation *in vitro* are illustrated and their significance discussed.

11. Effect of Light on the CO_2 Absorption and Evolution by Kalanchoe, Wheat, and Pea Leaves. By G. Krotkov, F.R.S.C., V. C. Runeckles, and K. V. Thimann.

Detached leaves of Kalanchoe, wheat, and pea were placed in a glass chamber in the presence of known amounts of $C^{14}O_2$ and were kept in either darkness or light for one hour. The residual $C^{14}O_2$ was then removed and its amount and activity determined. From these analyses the amounts of $C^{14}O_2$ taken in and $C^{12}O_2$ evolved by the leaves were calculated. In Kalanchoe and wheat, CO_2 uptake was observed both in light and in darkness, while in the pea it could be demonstrated only in the light. Evolution of CO_2 was observed in all species, not only in darkness but also in light. In wheat, evolution of CO_2 in the light was greater than in darkness, while the reverse was usually true in Kalanchoe and pea.

Tuesday, June 3

9.00 A.M.—Meeting of entire Section (Room Med. 142).

12. Invited Paper: Factors Influencing the Endocrine Pancreas. By R. E. Haist, F.R.S.C.

10.00 A.M. Meeting of Sub-section A (Room Med. 375).

13. Tetrapolarity and Culture Characteristics of some Tropical Species of *Cyathus*. By Harold J. Brodie. Presented by R. G. H. Cormack, F.R.S.C.

By analysis of the mating reactions of monosporous mycelia, it was shown that four tropical species of *Cyathus* are heterothallic and tetrapolar. Four other species were obtained in pure culture for the first time. Characteristics and behaviour of living mycelium of the various species of *Cyathus* indicated some species relationships at variance with the generally accepted taxonomic grouping.

14. Nuclear Streaming in Gelasinospora. By E. Silver Keeping (née Dowding). Presented by Dr. E. H. Moss, F.R.S.C.

Under some conditions, large numbers of nuclei of *Gelasinospora tetrasperma* travel through the mycelium for long distances, passing from one cell into the next *via* the septal pore. They are carried by the streaming cytoplasm at speeds as high as 40 cm per hour. Under other conditions, the moving cytoplasm leaves all the nuclei behind fixed in the thin cytoplasmic lining of the cell wall. Nuclei have been observed to stream in certain mated homokaryons but not in unmated ones.

15. Terminal Oxidase Enzymes of the Mature Sugar Beet Root. By D. J. Wort and M. Shrimpton. Presented by Edgar C. Black, F.R.S.C.

The results obtained by the application of selective inhibitors and specific substrates to tissue discs in Warburg respirometers suggest that the terminal oxidases of primary importance in the respiration of sugar beet root tissue are laccase and tyrosinase. No evidence of the participation of cytochrome oxidase, ascorbic acid oxidase, or glycolic acid oxidase was obtained spectrophotometrically or manometrically in the experiments.

16. On the Morphology and Taxonomy of the Dacrymycetaceae. By Lorene L. Kennedy. Presented by R. G. H. Cormack, F.R.S.C.

The Dacrymycetaceae is a group of closely related species of wood-inhabiting, jelly fungi which is characterized by a remarkably uniform, furcate basidium. The family is clear cut but the species are very difficult to identify because of lack of agreement on generic and specific limits. The morphology of these interesting fungi is described and a new classification of the family proposed.

17. Toxic Water-Blooms. By P. R. Gorham, A. Zehnder, R. E. Harris, M. McBride, and B. Simpson. Presented by Dr. W. H. Cook, F.R.S.C.

At least two toxic factors appear to be involved in the occasional death of animals caused by water-blooms of blue-green algae. One factor produces slow deaths, the other produces fast deaths. The slow-death factor is produced by certain bacteria associated with the algae. The fast-death factor is an endotoxin produced by the algae which so far has been detected in two strains of *Microcystis aeruginosa* but not in single strains of several other planktonic species suspected of toxicity. The production of the fast-death factor and its loss in the surrounding medium depend upon age and culture conditions.

18. Some Fossil Conifer Woods from the Cretaceous-Tertiary Boundary in Central Alberta. By J. D. Campbell. Presented by N. H. Grace, F.R.S.C.

In 1955 and 1956, about seventy-five specimens of fossil coniferoid wood in various states of preservation (together with a single piece of petrified anngiospermous wood) were collected from the Edmonton (uppermost Cretaceous) and lower Paskapoo (lowermost Palaeocene) formations in the coulees of the Red Deer River east of Red Deer city and around Drumheller, Alberta. All the specimens were found in place, so that their relationship to the stratigraphic column is known. In general, more and better wood was collected from the bottom 150 feet of the Edmonton formation; in younger horizons, with three notable exceptions from the Paskapoo, the wood tended to be more coaly. In the present investigation a number of these specimens are considered as to morphology and taxonomy and their relation to the floral changes from the bottom of the Edmonton to lower Paskapoo is discussed.

19. L'étude sur les vecteurs de Rickettsia burneti dans la Province de Québec. Par V. Pavilanis, M.D. Présenté par Armand Frappier, M.D., M.S.R.C.

On connait l'importance du pou dans la transmission des rickettsioses depuis le commencement de ce siècle. Déjà, en 1950, Giroud et Jadin ont soupçonné que le pou de vêtement peut avoir une certaine importance dans la transmission de la fièvre *Q*.

Pour prouver que le pou peut être infecté per os avec Rickettsia burneti, nous avons fait l'expérience suivante. Deux lapins furent inoculés par voie intraveineuse avec des Rickettsia burneti souche Herzenling. Une heure après l'injection, les poux ont été nourris sur les lapins. Le 5e jour après le repas infectant, nous avons pu, à l'examen direct, démontrer des rickettsies dans les excréments des poux. L'identité des rickettsies a été établie par les réactions sérologiques.

Cette expérience nous montre que le pou (pediculus vestimenti) peut être infecté avec

Rickettsia burneti pendant un seul repas sur un sujet malade. Le pou infecté ne présente aucune maladie et excrète les rickettsies pendant toute sa vie.

Dans un travail précédent, nous avons démontré que les moutons de la province de Québec sont infectés par la fièvre *Q* dans une très forte proportion. Nous avons recherché les vecteurs possibles de Rickettsia burneti chez les ovidés. Par amabilité du docteur L. Choquette, parasitologiste de la province de Québec, nous avons reçu six échantillons de Melophagus ovinus. Par inoculation au cobaye et aux poux, nous avons pu démontrer la présence de Rickettsia burneti dans quatre échantillons de mélophages.

Cette deuxième observation nous montre que le Melophagus ovinus joue un rôle important dans la transmission de Rickettsia burneti chez les moutons de la province.

10.00 A.M.—Meeting of Subsection B (Room Med. 142).

20. The Sizes of Fraser River Sockeye Salmon during the Period 1915 to 1957. By S. R. Killick. Presented by W. A. Clemens, F.R.S.C.

In an analysis of the average annual lengths and weights of the sockeye salmon proceeding to the Fraser River over the period of 1915 to 1957 a number of features have been revealed: (a) basically the size is related to the race or races present in the cycle years; (b) size increases for the most part as the season progresses; (c) the races occurring in the odd-numbered years are smaller than those occurring in the even-numbered years; (d) there appears to be a compensatory oscillation about a size mean. Reference will be made to the possibility of prediction of size.

21. The Effect of Environmental Salinity on Thyroid Activity and Metabolic Rate in the Flounder, *Platichthys stellatus*. By C. P. Hickman, Jr. Presented by W. S. Hoar, F.R.S.C.

The controversial relationship between thyroid activity and total metabolism of fishes has been reinvestigated in a euryhaline flounder. A significantly lower metabolic rate was demonstrated in fresh water adapted flounder than in marine flounder, indicating a greater expenditure of energy for osmotic work in salt water. Thyroid activity was studied in fresh- and salt-water adapted flounder by measuring thyroid uptake rates of radioiodine and its disappearance from the blood. When the goitrogenic effect of the low fresh water iodine was eliminated by adding iodine to the fresh water, thyroid clearance of I^{131} from the blood was significantly greater in the marine flounder. These results implicate a calorigenic action of the teleost thyroid hormone in an osmoregulatory role.

22. Muscular Fatigue and Mortality in Chinook Salmon (*Oncorhynchus tshawytscha*). By Edgar C. Black, F.R.S.C. and Robert R. Parker.

Blood samples were analysed for the fatigue product lactic acid from sixty-six chinook salmon caught by trolling fifteen miles off Cape Fairweather, Alaska, during August, 1957. Fish struggled on the line an average of fourteen minutes and were held in a live box up to ten and three-quarter hours. Lactic acid changes were similar to those found in three other salmonoids following severe exercise. During recovery twenty-two individuals died. Mortality was strongly associated with a very high blood level of lactic acid. [This project was supported by a grant-in-aid from the National Research Council of Canada, Ottawa.]

23. Retinomotor and Behavioural Responses of Juvenile *Oncorhynchus* to Light. By M. A. Ali. Presented by W. A. Clemens, F.R.S.C.

In response to changes in illumination the retinal pigment of visual cell layer of the Pacific salmon embryos does not show any photo-mechanical changes. The pigment layer has a latent period before undergoing contraction and in a few instances before expanding. The cones also may have latent periods of very short duration.

Sensitivity to light is independent of the state of the retinal pigment or visual cells, while full acuity of vision is dependent on the complete light adaptation of the cones. Feeding experiments show a close correspondence of feeding rates with the state of the cone layers. Schools disband when the light intensity decreases below the rod threshold.

Results are discussed in relation to the schooling and migrating behaviour of the juvenile Pacific salmon.

24. The Origin and Speciation of *Oncorhynchus*. By Ferris Neave, F.R.S.C.

The genus *Oncorhynchus* (Pacific salmon) has been derived recently from *Salmo*. The initial divergence is considered to have taken place within the last 400,000 to 800,000 years, most probably in the region of the present Sea of Japan. Differentiation of the six existing anadromous species of the genus was probably initiated by the development of distinctive breeding colour patterns during periods of geographic isolation of populations.

25. Changes in the Temperature Resistance of Goldfish Induced by Controlled Photoperiods. By William S. Hoar, F.R.S.C., and G. Beth Robertson.

Goldfish maintained at 20°C under controlled photoperiods for forty to seventy days were more resistant to heat (36°C to 37°C) when the periods of illumination were longer (sixteen hour days in comparison with eight hour days). Fish kept under eight-hour day periods were more resistant to cold (1°C to 2°C). Differences were more marked in winter than in summer. These seasonal variations may be related to endocrine changes associated with reproduction. Thyroid uptake of radioiodine was greater in the eight-hour day fish and treatment with thyroxine and related materials suggests that the thyroid may be involved in the increased resistance to low temperature.

2.00 P.M.—Symposium on "Potentialities of the North West." All sections.

Wednesday, June 4

9.00 A.M.—Meeting of the entire Section (Room Med. 142).

26. Flavelle Medallist's Address by A. G. Lochhead, F.R.S.C.

10.00 A.M.

27. Blood Lactic Acid and Liver Glycogen Levels in Stream-Dwelling Cutthroat Trout, Wild and Hatchery Reared. By Richard N. Miller. Presented by Ralph F. Shaner, F.R.S.C.

When hatchery-reared cutthroat trout are superimposed on wild, resident cutthroat trout in a stream the former lose weight and suffer high mortalities. Hatchery fish released

in the same stream, after the wild trout have been removed, gain in weight and few die. Blood and liver samples were taken from superimposed hatchery fish, hatchery fish in areas free of wild fish and from wild fish with and without hatchery fish among them. High blood lactic acid levels were associated with high mortality and competition; liver glycogen was higher in wild than in hatchery fish and showed striking seasonal variations.

28. Pathological Evidence on the Origin of Cultivated Flax. By A. W. Henry. Presented by A. G. McCalla, F.R.S.C.

Several authorities consider that cultivated flax, *Linum usitatissimum*, has been derived from the wild European species, *Linum angustifolium*. This view is based largely on morphological similarities, on like chromosome numbers, and on the success of the interspecific cross. Additional support for it has been provided by the present studies, which have shown that *Linum angustifolium* reacts to several pathogens of *Linum usitatissimum* as do varieties of the latter species. Most collections of both species, for example, have proved susceptible but some of each have been found to exhibit resistant reactions to the rust fungus *Melampsora lini*, from cultivated flax.

29. The Transaminases of *Pseudomanas Aeruginosa*. By Jack J. R. Campbell and A. M. MacQuillan. Presented by Edgar C. Black, F.R.S.C.

Cell free extracts of *P. aeruginosa* were tested for their ability to transaminate from 23 amino compounds to glyoxylate, pyruvate, oxalacetate and α-ketoglutarate. No transamination could be detected with pyruvate or oxalacetate as acceptors. However, purification of the extract allowed the demonstration of transamination to oxalacetate. Quantitative studies on various enzyme fractions indicate that the same enzyme does not transaminate both α-ketoglutarate and oxalacetate. Because of the negative data obtained with pyruvate as acceptor it was concluded that when this substrate is transaminated still another enzyme must be involved.

30. Adaptation in Douglas-fir through Frost Sensitivity Selection. By A. H. Hutchinson, F.R.S.C.

Douglas-fir varies ecotypically through its distributional range from the mountains of California to Stuart Lake in Northern British Columbia. In the temperate coastal region individual trees in a common association vary extremely. The record frosts of November, 1955 and January, 1957 provided critical tests of frost sensitivity which resulted in seedling killing or injury varying from 100 per cent to complete tolerance, according to seed source. The selection principles, including natural and planned selection, are considered.

31. Ecological Requirements of Douglas-fir, Western Hemlock, Sitka Spruce and Western Red Cedar. By V. J. Krajina. Presented by A. H. Hutchinson, F.R.S.C.

A greenhouse experiment, carried out in sand cultures and natural soil horizons on the four coastal tree species of British Columbia, proved as follows: (1) western hemlock is best adapted to poor supply of nutrients in podzolized soils; (2) Douglas-fir requires richer soil than hemlock; (3) Sitka spruce requires great amounts of magnesium; (4) western red cedar requires richest forest soils; (5) humus is a richer supply of nutrients than its respective mineral horizons; (6) trees affected by deficiencies and later treated by complete nutrition may recover.

32. The Relation of Bark Moisture to the Development of Cryptodiaporthe Canker on Willow. By J. E. Bier. Presented by A. H. Hutchinson, F.R.S.C.

Field and laboratory experiments prove that canker development occurs in willow bark with relative turgidity less than 79 per cent. On occasion the relative turgidity of dormant willow bark falls below this value. During winter the relative turgidity of bark may be increased to values above 80 per cent by placing dormant cuttings in water outdoors. Such increases have resulted in a cessation of canker growth. Similar results are obtained after willows break dormancy. During the growing season of 1957 the relative turgidity of the bark tissues in the field was above 80 per cent, coinciding with the cessation of canker growth and the production of callus host tissue around the margin of lesions.

33. Observations on the Spruce Complex in the Rocky Mountain Area. By T. M. C. Taylor. Presented by A. H. Hutchinson, F.R.S.C.

A consideration of the marked variability in spruce, particularly with reference to cone structures, in the areas of distributional overlap of species.

34. Some Growth Patterns in Norway Spruce (*Picea abies* (L.) Karst.). By J. L. Farrar. Presented by N. H. Grace, F.R.S.C.

35. Locomotor Performance and Osmoregulation in Juvenile Anadromous Salmonids Transferred Abruptly from Fresh to Sea Water. By A. H. Houston. Presented by W. S. Hoar, F.R.S.C. (By title)

Chum salmon fry (*Oncorhynchus keta*) exhibit transient but significant decreases in maximum swimming speed following transfer from fresh to 75 per cent sea water. Changes in performance correlate well with variations in total body chloride and water. Studies on Steelhead trout (*Salmo gairdneri gairdneri*) indicate an immediate transfer of water from intracellular to extracellular phases after entry into sea water. Cellular uptake of calcium by muscle occurs. Changes in distribution and concentration of sodium and potassium take place. The data suggest that cellular dehydration, generalized cellular electrolyte uptake, and specific ion effects may produce a reduction in metabolic efficiency of muscle, which is reflected in performance.

36. Photoperiodic Effect on Oxygen Consumption of Two Species of Crabs. By Paul A. Dehnel. Presented by W. S. Hoar, F.R.S.C. (By title)

Oxygen consumption measurements were made on summer male populations of *Hemigrapsus nudus* and *H. oregonensis*. Groups of each were exposed to three light conditions: eight hour daily illumination (30 foot candles), sixteen hour illumination, and controls (dark). All were kept at constant temperature (15°C) and salinity (35 per cent sea water) combinations approximating summer field conditions. Respiratory response to this temperature-salinity combination, exclusive of light, was established first. Oxygen consumption was highest in the eight hour experimental group. The increase for a 2.0 gram animal was 55 per cent for *Hemigrapsus oregonensis* and 36 per cent, *H. nudus*. Sixteen hour and control groups were similar, and this persistence was demonstrated for other temperature-salinity combinations.

Section V, Wed. p.m.

2.00 P.M.—Meeting of the entire Section (Room Med. 142).

37. Invited Paper. Chromosome Sex and Phenotypical Sex. By Murray Barr, F.R.S.C.

3.00 P.M.—Business Meeting of Section (Room Med. 142).

4.00 P.M.—General Meeting of the Society.

8.00 P.M.—Oceanographic Symposium on "How Oceans Make Fisheries" (Room Med. 142). Symposium sponsored by Section V and Committee on Oceanography.
Chairman: Dr. W. A. Clemens, F.R.S.C., Director of the Institute of Oceanography, University of British Columbia.
Introduction: Dr. J. L. Kask, Chairman, Fisheries Research Board of Canada.

1. Salmon of the North Pacific. By A. W. H. Needler, F.R.S.C. (Director, Pacific Biological Station).

This paper will outline the recent large-scale investigation of the distribution of various Pacific salmon stocks in the North Pacific and Bering Sea undertaken by the United States, Japan, and Canada to provide the International North Pacific Fisheries Commission with the basis for equitable action regarding the fisheries of the high seas. Oceanography forms an essential part of the INPFC research programme and salmon distribution can already be correlated broadly with the oceanographic system of the region. Salmon stocks having their fresh-water life in various areas have been identified by various characteristics. Their intermingling over broad areas of the North Pacific and their reappearance unmixed in their rivers of origin have been shown.

2. The Atlantic and its Fisheries. By J. L. Hart, F.R.S.C. (Director, Atlantic Biological Station).

As marine fish are found in the sea it is generally assumed that their abundance and liability to capture must be influenced by oceanographic conditions. Observations of general trends support this assumption. Research by the Fisheries Research Board's St. Andrews Biological Station shows interesting relationships between oceanographic conditions and fishery phenomena for scallops, lobsters, haddock, cod, and herring.

3. Salmon in Fundy's High Tides. By A. G. Huntsman, F.R.S.C. (formerly Consulting Director, Fisheries Research Board of Canada).

Without eyes to look down and with the bottom invisible except in shallow water, salmon go with the current when out in the ocean. With deep enough water, most of them remain in lakes or do not go far on reaching the ocean. Along the course that water takes from spawning streams near Halifax to and through the Bay of Fundy, there are four distinct populations of salmon of diverse origin that provide distinctive fisheries, all in accordance with water conditions. Salmon fished in the outflow from the Petitcodiac tidal bore remain quite locally even beyond when they should have spawned.

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